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MONOGRAPH OF THE STROPHOCHEILIDAE, A NEOTROPICAL FAMILY OF TERRESTRIAL MOLLUSKS

By Joseph C. Bequaert

With Thirty-Two Plates

CAMBRIDGE, MASS., U. S. A.
PRINTED FOR THE MUSEUM
March, 1948

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No. 1—*Monograph of the Strophocheilidae, A Neotropical Family of Terrestrial Mollusks*

By Joseph C. Bequaert

CONTENTS

Page
Introduction 3
  Measurements 7
  Specific Characters 8
  Genera and Subgenera 9
  Illustrations 10
Family Strophocheilidae 13
  Characters 13
  Distribution 14
  Subfossil and Fossil species 15
  Trivial Names Proposed, with Their Present Equivalents . . . 17
Genus *Strophocheilus* Spix 22
  Characters 22
  Ethology 24
  Excluded Species 25
  Synopsis of Subgenera 26
  Subgenus *Strophocheilus*, proper 27
  Subgenus *Speironepion* J. Bequaert 48
  Subgenus *Megalobulimus* Miller 54
  Subgenus *Microborus* Pilsbry 167
  Subgenus *Chiliborus* Pilsbry 176
Genus *Gonyostomus* Beck 187
  Characters 187
  Synopsis of Subgenera and Species 188
  Doubtful and Excluded Species 189
  Subgenus *Gonyostomus*, proper 190
  Subgenus *Anthinus* Albers 196
Index 203

INTRODUCTION

The Strophocheilidae contain some of the largest living terrestrial snails, hence are among the most conspicuous members of the South American fauna. Being at the same time peculiar to the New World, they are one of the distinctive elements of the Neotropical Region. To the zoögeographer they are of more than usual interest as representing a South American branch of the acavid stock, an ancient, primitive group of pulmonate land snails with a disconnected circumpolar distribution in the Southern Hemisphere. Most authors speculate that the ancestors of the Recent superfamily Acavacea originated at some remote geological period (probably before the Mesozoic) on a single fairly continuous Austral continent, extending perhaps at one time from the South Pole to near the Equator. When this hypothetical "Gondwana Continent" or "Antarctica" broke up, supposedly from the middle of the Mesozoic onward, it is claimed that the descendants of the primitive Acavacea became isolated in four widely disconnected areas, where further evolution eventually produced a number of distinct Recent groups, now ranked as either families or subfamilies. In the Australian area the Caryodidae include both bulimoid and helicoid snails. In the region extending from Madagascar to Ceylon the Acavidae contain mostly helicoid, and the Clavatoridae only bulimoid forms. The Dorcasiidae are a helicoid group of Acavacea restricted to a small section of western South Africa. In South America the superfamily seems to have survived best, as it now covers a very wide area and comprises more species than elsewhere, the majority of them being bulimoid (Strophocheilidae), with a few helicoid forms (Macrocyclidae) restricted to Chile. L. Plate and C. R. Boettger believe that the Strophocheilidae are among the most primitive of the Recent Acavacea, which might indicate that South America was farthest from the primitive center of evolution of the superfamily. Moreover, the Strophocheilidae probably arose from the same ancestral stock as the Bulimulidae, a non-acavid family of land snails now dominant in the New World tropics.[1] The anatomy of the South African Dorcasiidae was found to be as primitive as that of the South American Strophocheilidae, which led C. R. Boettger (1936) to unite both groups in one family (or subfamily). Boettger assumes that they were derived from some common ancestral stock on a hypothetical landmass (Archhelenis of H. v. Ihering), which presumably united eastern Brazil and Africa across the southern Atlantic some time before or during the Mesozoic.

The latest and only comprehensive study of Strophocheilidae, by Dr. H. A. Pilsbry in the Manual of Conchology (1895–1902) was written before the family limits were clearly defined. Additional forms have been described meanwhile, while much information has accumulated on others. The present revision intends to supplement Pilsbry's work and should be used jointly with it. I have attempted in the first place to delimit the species more clearly, taking into account the range of individual variation, in order to establish the true value and natural relationship of the several named forms. Following this, I have tried to define the geographical distribution of the species and subspecies which I regard as probably distinct. Both these aspects of taxonomy should, of course, always be considered together, as they complete and illuminate each other. I admit freely that, from both points of view, I am far from satisfied with the results, which are only too often provisional, raising questions rather than providing answers.

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[1] The distribution and evolution of the Acavacea have been discussed at great length by H. Watson (in M. Connolly, 1915, Ann. South Afric. Mus., **13**, pt. 4, pp. 122–123), L. Germain (1925, C. R. Congr. Soc. Savantes, pp. 254–268), and C. R. Boettger (1936, C. R. XII^e Congr. Intern. Zool., Lisbon, 1935, **2**, pp. 1033–1050).

The two great drawbacks in the study of the Strophocheilidae are the lack of adequate series of specimens for most species and the dearth of reliable accurate localities. Paradoxical as it may seem, the former handicap is due mainly to the large size of many of these snails. While the shells are located without difficulty, except when they are buried during droughts, the average collector hesitates to burden himself with more than a few. He assumes that such large snails are well known and prefers to fill his luggage space with many more specimens of the smaller, presumably lesser known species. As a result, the relatively few specimens obtained by dealers, private collectors and museums have usually been selected for some striking peculiarity, particularly of size or shape, the more normal or average specimens being left behind. A large series, showing the complete range of individual variation within a colony or in one locality, is seldom available for study. To make matters worse, the Strophocheilidae, like most large mollusks, are great favorites with amateur conchologists, consequently with dealers, who are only too prone to display or list as many "species" as possible. Names are then proposed for unusual specimens, in blissful ignorance of the true relationship. The burden of unravelling these names rests upon the unfortunate reviser, who is expected not only to complete the fragmentary original descriptions, but also to exercise the utmost caution in his attempts at degrading the supposed "species" to their correct status either as "subspecies" or as "synonyms."

Even in large museums curators are sometimes weary of accumulating permanently extensive series of large snails. Being only too often in cramped quarters, they feel that they should not devote to a few large species space that could accommodate, perhaps to better purpose, many representatives of the smaller forms. No museum can boast at present of an adequate collection of Strophocheilidae, particularly if it be noted that about three-fourths of the available specimens lack reliable or definite localities.

In preparing this revision, I was unable to study the European collections. I have seen, however, all those of the important North American museums, particularly the Museum of Comparative Zoölogy (cited as M.C.Z.), the United States National Museum (U.S.N.M.), the Academy of Natural Sciences of Philadelphia (Ac.N.S.Phila.), the Chicago Natural History Museum (M.N.H.Chic.), the American Museum of Natural History in New York (A.M.N.H.), and the Museum of Zoology of the University of Michigan (M.U.Mich.). I wish to acknowledge with thanks the help I have received in this connection from the Curators in charge of these collections, Mr. W. J. Clench, Dr. P. Bartsch, Dr. H. Rehder, Dr. H. A. Pilsbry, Mr. R. McLean, Dr. F. Haas, Mr. F. V. Weir, Mr. C. Goodrich, and Dr. H. Van der Schalie. I have also examined specimens in Mr. Ralph Humes' collection. I have been especially fortunate in enlisting the assistance of Dr. Oliverio M. de Oliveira Pinto, Director of the Departamento de Zoologia, Secretaria da Agricultura (formerly Museu Paulista), in São Paulo. He not only arranged for an exchange with the M.C.Z. of a series of Brazilian species, with fully reliable localities, including several paratypes or topotypes, but in addition sent for study other, even more valuable material from the collections of his Department (D.Z.S.P.). The M.C.Z. has also received some interesting material from Dr. Max Birabén and Mrs. María I. Hylton Scott de Birabén in La Plata.

To Mr. W. J. Clench and his associates at the Department of Mollusks of the Museum of Comparative Zoölogy I am particularly indebted for advice, criticism and assistance of every kind.

I have studied all the types that could be located in the North American collections and have figured them anew. Under present conditions it was not possible to see any of the types in European collections. For first-hand information concerning some of them, I am under particular obligation to the late Major M. Connolly (British Museum), Dr. W. Adam (Brussels Museum), and Dr. E. Fischer (Paris Museum).

An earlier plan to reduce the bibliography to a strict minimum had to be abandoned, because Pilsbry's references are not only too few for practical purposes, but also mostly without or with incorrect dates. The bibliographies now presented under each species or race are believed to be reasonably complete. With very few exceptions the citations were compared with the originals and examined critically before listing them under the respective headings.[1] I have included with each reference the most important information it contains, particularly all localities not previously mentioned. Special care was given to the actual date of publication, which in each case follows immediately the author's name; while other dates printed on the cover or title-page of the publication are cited in parenthesis after the volume or part number. In critical cases, the month or sometimes even the day have been traced from the best available sources. In their present form, the bibliographies give the complete history of all accepted names and synonyms.[1] Pre-Linnean references and others without nomenclatorial standing are in brackets.

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[1] Mr. R. McLean has kindly checked for me, at the Academy of Natural Sciences of Philadelphia, the references in Hidalgo's "Moluscos del Viaje al Pacífico." The one reference to Strobel's "Materiali per una Malacostatica dell'Argentinia Meridionale," was verified by Dr. Harald A. Rehder at the U. S. National Museum.

It is unfortunate that Pilsbry did not copy the original descriptions of the Strophocheilidae, as became his practice in later volumes of the Manual. Moreover, some of the descriptions he reproduces are not those of the first describer. It is not possible to remedy this defect in the present paper. I had to be content with including a few of the earliest first descriptions, when needed for an intelligent discussion of the species, and some others inaccessible to the majority of malacologists.

Measurements. Measurements were determined to the half-millimeter only, a sufficient approximation for large shells. Whenever available, a fair number of specimens were selected to show the variations connecting extremes of size and shape, beginning with the longest. It will be seen that in most species size and shape are so variable that they can scarcely be relied upon, unless supported by other characters. The *length* (or height) is that of the longest vertical axis of the shell, measured from the tip of the spire to the basal edge of the outer lip. The *width in front view* is the largest transverse diameter, measured at right angles to the vertical axis, from the left margin of the body-whorl to the farthest outer edge of the outer lip. The *width in profile* is the dorso-ventral thickness of the body-whorl, measured at right angles to the vertical axis. In the *aperture,* the measured *length* is the longest diameter or axis, from the upper end of the junction of outer lip and parietal wall to the basal edge of the outer lip; the *width* is the greatest transverse diameter, measured at right angles to the length *inside* the peristome, from the inner edge of the columella to the inner edge of the rim of the outer lip. This system of measuring was used by previous authors, except for the width of the aperture, which some of them (notably Pilsbry) have measured from the inner edge of the columella to the *outer* margin of the rim of the outer lip.[2] I prefer the present method because in several species of *Strophocheilus* the rim of the outer lip grows by accretions after adult size is reached, so that if the width of the aperture is measured to the outer margin of the rim it will vary with age in the same adult individual. Even so, however, the width of the aperture is sometimes difficult to determine correctly and is the least reliable measurement.

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[1] The year inserted in the text after an author's name refers to a citation in the bibliographies of the species and subspecies.

[2] In some cases v. Martens has given the width of the aperture both inside and outside the rim.

Specific Characters. In attempting to define the species and to trace the relationship or relative value of the many named forms, I have been led gradually to attach an increasing importance to the sculpture, particularly of the nepionic shell. To be fully reliable, this should be studied on fresh and perfect specimens and, whenever possible, on young shells. Immature shells, definitely referable to species known as adults, are of the utmost value and should always be collected and kept in museums. They should, however, not be used alone for the description of new species or races. Badly worn or weathered shells are sometimes nearly impossible to determine with accuracy. For this reason, relatively little information of value can be obtained from most of the fossil or subfossil specimens. The size, the general outline of the shell, and the shape of aperture and umbilical slit I have found extremely variable in most species of which large series could be studied. Color differences are even less reliable, particularly the presence or absence of a pale subsutural band and the color of the peristome. It is true that some species are known only with a white peristome; but in those where it is normally pink or orange, there are generally individuals in which it is perfectly white even in life. Most species of *Strophocheilus* appear to be very long-lived and in old age some of them tend to thicken the shell and to deposit additional layers of lime at the edge of the peristome. Such accretions are particularly noticeable at the rim of the outer lip, which is sometimes provided with a very wide accrescent extension. Some species are normally heavier and thicker in the texture of the shell than others. It should be noted, however, that the shell sometimes becomes heavier after death, which explains the thicker texture of most subfossil specimens. Any described form characterized only by minor or highly variable characters I am inclined to regard as either an individual variant (hence a synonym) or at most as a race (subspecies). Nevertheless, owing to the paucity of available material for some of the species, I have been rather over-cautious in reducing the number of named forms. I feel that the next reviser will sink many of the accepted "subspecies" as synonyms and reduce some of the so-called "species" to subspecific rank. At present it is only possible to suggest some of these changes.

All forms below the level of species, recognized as distinct in this paper, have been given the status of subspecies or races, although it is realized that they do not all have the same taxonomic value. Some of them are no doubt merely extremes of individual variation, as yet unrecognized as such. Others may be mutations or sports, or even mere abnormalities, probably of only transitory importance in evolution. Others again are possibly ecological races, produced by fairly constant environmental factors, yet not definitely established as hereditary entities. Finally, a few may be true subspecies, in the more customary sense of geographical races, due to protracted spatial or ecological isolation within the general range of the species. In the case of the Strophocheilidae, it is at present impossible to put these distinctions on a strictly factual basis. Meanwhile it seems at least practical to treat all the forms as equivalent from the point of view of nomenclature, since recently adopted rules recognize no trinomials unless clearly published with subspecific status.

Genera and Subgenera. Modern taxonomists attempt to group into genera and subgenera species which they consider to be more or less related in a phylogenetic sense. However, there is usually little or no agreement as to which characters are of the greatest value in order to establish this relationship. Most students of mollusks tend nowadays to attach more importance for this purpose to anatomical features than to shell characters. In some cases this tendency has been stretched to the point of absurdity, many genera being based on trivial differences in the radula or in the soft parts. One should not lose sight of the fact that the generic concept has also become the main guide-post of taxonomy, particularly to the general biologist. Mainly for this practical reason, I prefer to adopt relatively few, fairly comprehensive genera. In the case of the Strophocheilidae, it should be noted, moreover, that the anatomy is known as yet for very few species, as shown in the sequel, and that these few species do not include the genotypes of *Strophocheilus* and *Gonyostomus,* nor any member of the typical subgenera.

Since the grouping of the species must therefore of necessity proceed at present on the basis of shell characters alone, I feel that further progress in the knowledge of the Strophocheilidae will be served best by retaining only two genera. *Strophocheilus* and *Gonyostomus* are both easily recognized by the general appearance of the shell, as well as by certain peculiarities of shape, sculpture and coloration.

I further subdivide *Strophocheilus* into five subgenera: *Strophocheilus,* proper, *Speironepion, Megalobulimus, Microborus,* and *Chiliborus.*

These are sharply defined by the distinctive sculpture of the nepionic shell. Those who may feel the need for more narrowly defined genera, containing fewer species, may raise the subgenera to generic rank.

The case of *Gonyostomus* is somewhat different. It contains few species, all agreeing in the type of nepionic sculpture. I have grouped these on the shape of the aperture in two subgenera, *Gonyostomus*, proper, and *Anthinus*. Unless some important anatomical differences be discovered between the two groups, it is unlikely that many malacologists will feel inclined to raise their status.

Illustrations. Previous illustrations of Strophocheilidae have been from drawings, with few exceptions. I am now publishing at least one photograph of every species seen, as well as enlargements of the summit of a few. Nearly every type specimen available in North and South American collections is figured. Through the kindness of Dr. E. Fischer, I was also fortunate in obtaining photographs of some types of Rang, Michelin, Hupé and Jousseaume now preserved at the Paris Museum. Unless otherwise indicated, the photographs of the shells are by Mr. F. P. Orchard and those of the summits by Mr. Frank White.

There has been some divergence of opinion in interpreting the figures of Strophocheilidae in the old iconographies, which are frequently consulted even to-day. Every published figure has here been considered anew in the light of the rather large material seen, the result disagreeing sometimes with earlier identifications. Although listed in the bibliographies of the several species, the older illustrations may be difficult to trace there, so that I am prompted to bring them together in the order in which they were published. I have added a few remarks on the dates of publication, which are sometimes in dispute.

1. Férussac, Histoire Naturelle Mollusques Terrestres Fluviatiles (completed by Deshayes). I follow A. S. Kennard (1942, Proc. Mal. Soc. London, 25, pt. 1, pp. 12–17, and pt. 3, pp. 105–118) with regard to the dates of publication of the Plates cited below. Of these only Pl. 145B and Pl. 147 were published by Férussac, the first in 1832 (with the full specific name printed on the plate), the second in 1823 (without trivial name on the plate and apparently without explanation of the plate on its wrapper). All other plates which concern us here were published by Deshayes, after Férussac's death, presumably in 1851.

Pl. 130, figs. 7–8: *Gonyostomus multicolor miersii.*
Pl. 139, figs. 15–16: *Strophocheilus lutescens.*
Pl. 139, figs. 20–21: *Strophocheilus rosaceus.*

Pl. 139, figs. 22–23: *Strophocheilus chilensis.*
Pl. 143, figs. 4–5: *Strophocheilus planidens.*
Pl. 143, fig. 6: *Strophocheilus unidentatus.*
Pl. 143, figs. 7–8: *Gonyostomus egregius.*
Pl. 143, figs. 9–10: *Gonyostomus goniostoma.*
Pl. 143, figs. 11 and 13: *Strophocheilus pudicus.*
Pl. 143, fig. 12: *Strophocheilus pudicus roseolabris.*
Pl. 145, figs. 1–2: *Gonyostomus multicolor.*
Pl. 145B, fig. 1: *Strophocheilus granulosus.*
Pl. 145B, figs. 2–2*a*: *Strophocheilus bronni.*
Pl. 146, figs. 1–2: *Strophocheilus valenciennesii.*
Pl. 146, figs. 3–4: *Strophocheilus oblongus haemastomus.*
Pl. 147: *Strophocheilus ovatus.*
Pl. 160, figs. 11–12: *Strophocheilus ovatus chionostoma.*

2. G. B. Sowerby, Jr., Conchological Illustrations. For the dates of publication of this erratic work, see H. O. N. Shaw (1909, Proc. Mal. Soc. London, **8**, pt. 6, pp. 333–340) and A. Reynell (1910, *op. cit.*, **9**, pt. 3, pp. 212–213). Each numbered part consisted of one plate, in a wrapper, with a printed list on small paper (usually dated) of the names of the species figured.[1] In the case of *Bulinus*, a first list of all the species figured (pp. 1–4) was issued at some unknown date, probably with Pt. 186 (in October, 1840) which completed the genus. In 1841, however, a revised list of figures of *Bulinus* (paged 5–8) was issued with Pt. 200 (concluding the work) and in this some of the specific names were changed. From the information available at present, the parts which concern us are dated as follows: Pt. 22, March 15, 1833. Pt. 31, some time between May 17 and July 12, 1833; the printed list issued with this part is not dated. Pts. 137, 138, 140, and 144, some time in 1838, before October 31. Pts. 145 and 146, October 31, 1838.

Pt. 22, fig. 4: *Strophocheilus chilensis.*
Pt. 22, fig. 5: *Strophocheilus rosaceus.*
Pt. 31, fig. 33: *Strophocheilus lutescens.*
Pt. 137, fig. 59: *Strophocheilus leucostoma.*
Pt. 138, fig. 63: *Strophocheilus maximus.*
Pt. 140, fig. 76: *Strophocheilus auritus.*
Pt. 144, fig. 89: *Gonyostomus multicolor.*
Pt. 144, fig. 90: *Gonyostomus multicolor miersii.*
Pt. 144, fig. 94: *Strophocheilus milleri.*
Pt. 145, fig. 98: *Strophocheilus pudicus.*

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[1] An incomplete copy, at the M.C.Z., has each plate as originally issued, in its wrapper, with the printed list of contents. Parts 22 and 31 are included in this copy.

Pt. 146, figs. 101 and 103 (left): *Strophocheilus oblongus haemastomus.*

Pt. 146, fig. 102: *Strophocheilus terrestris.*

Pt. 146, fig. 103 (right): *Strophocheilus oblongus musculus.*

3. A. d'Orbigny, Voyage dans l'Amérique Méridionale, **5**, pt. 3, Mollusques. For the dates of publication, see C. D. Sherborn and B. B. Woodward, 1901, Ann. Mag. Nat. Hist., (7), **7**, pp. 388–390; and C. D. Sherborn and F. J. Griffin, 1934, *Op. cit.*, (10), **13**, pp. 130–134. According to these writers, the text covering the Strophocheilidae appeared in 1837. The dates of publication of the plates, which bear specific names, are not known exactly; but it is here assumed that they appeared the same year as the corresponding text, there being no evidence to the contrary.

Pl 34, figs. 11–13: *Strophocheilus rosaceus.*

Pl. 35, figs. 1–2: *Strophocheilus maximus.*

Pl. 35, fig. 3: *Strophocheilus maximus vestitus.*

Pl. 36, figs. 1–2: *Strophocheilus santa-cruzii.*

Pl. 36, figs. 3–4: *Strophocheilus leucostoma.*

Pl. 36, figs. 5–6: *Strophocheilus leucostoma lacunosus.*

Pl. 37, figs. 1–3: *Strophocheilus intertextus* (probably).

It should be noted that in the Explanation of Plates (p. 695) Pl. 36 is explained as Pl. 37, and Pl. 37 as Pl. 36.

4. L. A. Reeve, Conchologia Iconica, **5**, Monograph of the Genus *Bulimus*. In this work the unpaginated letterpress issued with each plate is dated as to month and year. Of the illustrations of Strophocheilidae, Plates 15 to 51 appeared in 1848, Plate 82 in 1849, and Plates 88 and 89 in 1850.

Pl. 15, fig. 87: *Strophocheilus pachychilus.*

Pl. 15, figs. 87*a-b*: *Strophocheilus rosaceus.*

Pl. 17, fig. 99: *Strophocheilus lutescens.*

Pl. 19, fig. 117: *Strophocheilus bridgesii.*

Pl. 28, figs. 169*a-b*: *Strophocheilus milleri.*

Pl. 31, fig. 191: *Strophocheilus calus.*

Pl. 31, fig. 192: *Strophocheilus unidentatus.*

Pl. 34, figs. 204*a-b*: *Strophocheilus valenciennesii.*

Pl. 34, fig. 205: *Gonyostomus egregius.*

Pl. 34, fig. 206: *Gonyostomus goniostoma.*

Pl. 35, fig. 208: *Strophocheilus santa-cruzii.*

Pl. 35, fig. 209: *Strophocheilus granulosus.*

Pl. 35, fig. 210: *Strophocheilus oblongus.*

Pl. 36, fig. 212: *Strophocheilus ovatus.*

Pl. 39, fig. 238: *Gonyostomus multicolor.*
Pl. 39, fig. 239: *Gonyostomus multicolor miersii.*
Pl. 51, fig. 337: *Strophocheilus maximus.*
Pl. 82, fig. 607: *Strophocheilus terrestris.*
Pl. 88, fig. 658: *Strophocheilus contortuplicatus.*
Pl. 89, fig. 212*b*: *Strophocheilus ovatus.*

FAMILY STROPHOCHEILIDAE

Characters. I follow Thiele (1931, Handbuch System. Weichtierk., **2**, p. 650) in ranking the Strophocheilidae as a family of the Superfamily (or Stirps) Acavacea; although it may be equally correct to recognize only one family Acavidae in this major group, reducing the Strophocheilinae to subfamily status. As here understood, the family comprises all South American bulimoid snails, theoretically at least with a characteristic acavid anatomy. As a matter of observed fact, however, the anatomy is known more or less completely for only four species of *Strophocheilus* and one of *Gonyostomus*; so that the majority of the species are grouped together on the strength of the shell characters alone. As *Dryptus* was also classified in Strophocheilidae on the characters of the shell, until a recent study of the anatomy removed it to Bulimulidae,[1] it may be suspected that some other subgenera of *Strophocheilus* may also have to be eliminated from the family.

The general shell characters are: (1) The bulimoid shape, the shell being higher than greatest width, usually much so, with relatively large and often capacious body-whorl and short spire. (2) A non-truncate columella, continuous with the base of the outer lip. (3) A well-formed, thickened and more or less expanded or reflexed rim at the outer lip in the adult. (4) A voluminous nepionic shell, usually with strong sculpture of vertical ribs or spiral striae, and generally also granulose. (5) A relatively narrow or closed umbilicus. The only other South American acavid snails, the Macrocyclidae, are flattened, helicoid, with very wide umbilicus.

The animal is characterized externally by the lack of a lateral furrow or fringe on the foot and by the absence of a caudal pore or gland. In *Strophocheilus oblongus* and *S. ovatus* the anterior end, or snout, is provided dorsally with a pair of broad buccal flaps, more or less connected or fused medially and festooned at the free edge. Whether these flaps are present also in other species of this genus and in *Gonyo-*

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[1] See H. B. Baker, 1926, Occ. Papers Mus. Zool. Univ. Michigan, No. 167, pp. 25–30. *Thaumastus* was excluded from Strophocheilidae by Pilsbry in 1902.

stomus is not known at present. The egg is large for the size of the snail and has a hard, calcareous shell.

Internally, the jaw is very thick and strong, usually with prominent folds or riblets and transversely striate. The large radula consists of numerous teeth, regularly arranged in many horizontal rows (up to 100 teeth in one row), all the teeth very similar, relatively simple and quadrate, the central only differing from the laterals in being bisymmetrical; the central and laterals are unicuspid, with a broad, pointed or blunt cusp; some or all marginals are bicuspid or tricuspid, but with very small ectocones. The genital organs are simple: the free oviduct lacks a dart sack and is either swollen or provided with an appendiculum at the junction with the duct of the spermatheca. The lung is short, with at least two main pulmonary veins, which are sometimes much branched. The kidney is very simple, without differentiated ureter (anurethrous), opening by means of a simple papilla in the pallial cavity. From this inner structure it would appear that the Strophocheilidae have retained more primitive characters than most other Recent Acavacea.

Distribution. The Strophocheilidae comprise in this paper only two genera: *Strophocheilus*, with the subgenera *Speironepion*, *Megalobulimus*, *Microborus* and *Chiliborus*; and *Gonyostomus*, with the subgenus *Anthinus*. I recognize 41 Recent species, 37 of *Strophocheilus* and 4 of *Gonyostomus*. They are indigenous in South America north of 40° Lat. S., including Trinidad. The occurence of *S. oblongus* in some of the Antilles proper is in my opinion due to introduction by man. No species has been found in or north of the Isthmus of Panama. There appear to be four main centers of density of species. The most important of these is in the eastern half of Brazil, from Maranhão to Rio Grande do Sul, the home of all species of *Gonyostomus* (4 species), *Speironepion* (2 species), and *Strophocheilus* proper (7 species), as well as of 10 species of *Megalobulimus*. A second center is in the Andean area, from Bolivia to Colombia, which harbors 8 precinctive species of *Megalobulimus*. The subgenus *Microborus*, with 3 species, is peculiar to Uruguay and northern Argentina; while *Chiliborus*, with 4 species, is restricted to central Chile. Only one species, *S. oblongus*, is more generally distributed, but has produced some peculiar races in eastern Brazil and in the Uruguay-Argentina area.

The Strophocheilidae comprise some of the largest known living terrestrial snails, being only exceeded in size by certain African Achatinidae. Moreover, these two families seem to replace each other on their respective continents, where they occupy to some extent the same ecological niche; although the Achatinidae are more prolific in genera and species and have even developed arboreal types. In some cases, the shells of the two families have become superficially similar through convergence. The South African *Metachatina* and the Central African *Burtoa* particularly simulate certain species of *Megalobulimus*; but their nepionic shells are small and decussately sculptured, as in the other Achatinidae, where both genera are no doubt correctly placed, although the anatomy is known only for *Burtoa.*

Leucotaenius, of Madagascar, is in shell characters even more like the smaller *Strophocheilus* than either *Burtoa* or *Metachatina.* In addition to the similarity in bulimoid shape, the nepionic shell is large and sculptured with regular riblets as in *Megalobulimus*; while the parietal wall is humped close to its junction with the outer lip, a feature present in several species of the South American group. Unfortunately the anatomy is as yet little known and Thiele (1931) retains *Leucotaenius* tentatively in Achatinidae. There can be little doubt, however, that the genus belongs in Acavacea, the similarity being due in this case to affinity, not to convergence. It should be included in the family Clavatoridae, as was proposed by Germain (1913, Bull. Mus. Hist. Nat. Paris, **19**, p. 476), who ranks *Leucotaenius* (= *Pseudoclavator*) merely as a subgenus of *Clavator.*

Subfossil and Fossil Species. In view of the primitive character of the Recent Strophocheilidae and of their relations to the other Acavacea of the Southern Hemisphere, pointed out in the introduction, any information obtainable from the fossil record may be of great interest. Such data, however, need to be considered with care before conclusions be drawn.

In the first place, it is essential to determine whether the fossilized specimens are true fossil forms, which presumably lived or became extinct before the Recent period, or only subfossil shells of living species or of such as disappeared during or after the Pleistocene. The distinction may be sometimes difficult to make, owing to the habit of these large snails to estivate within cracks, caves or holes, or buried at some depth in loose soil. If they die during estivation, the shells may become imbedded in the surrounding soil and, under certain conditions, even become fossilized within a comparatively short time. Eventually they may appear to be part of the original fauna of the old strata in which they are discovered, while they are actually only Recent subfossils. For this reason it is probably advisable to regard as only subfossil all dead buried shells which do not differ markedly from living species, The shell which I describe in this paper as *Strophocheilus terrestris oliveirai* is clearly subfossil, although it is not known as yet in the living state. Pilsbry (1900), H. v. Ihering (1907) and Marshall (1908) record subfossil specimens of *S. globosus* from Uruguay in deposits which v. Ihering supposes to be of Pleistocene age. I am convinced that *S. ovatus* subsp. *iguapensis* Maury (1935), based on presumably fossil shells found in probably Pleistocene deposits, is identical with the living *S. yporanganus*, found in the same locality. I have listed it as a synonym of that species. *Megalobulimus toriii* Lange de Morretes (1937), described from subfossil shells found in old Indian kitchen-middens, is only subspecifically distinct from *S. yporanganus*.

Döring (1884) used the name *Bulimus oblongus* var. *crassa* Albers for fossils from the "piso eolítico (subformación pampeana superior)" of northern Argentina.[1] H. v. Ihering (1897) referred to the same subspecies casts from the Paraná deposits of Entre Ríos, which he regarded as possibly Miocene while Ameghino (1906) placed them later in the Oligocene. Whether these identifications are actually reliable is open to question.

The presumably subfossil *Borus rimanni* var. *fossilis* Frenguelli (1918), as well as the *Borus rimanni* Frenguelli (1918) from old Indian burying grounds, both from northern Argentina, I am unable to separate from Recent *Strophocheilus cordillerae*.

It is difficult to decide what to do about *Strophocheilus sancti-josephi* Maury (1935), described from strata, in the State of Rio de Janeiro, "probably Miocene, with an upper limit of Pliocene." If it is correctly placed in Strophocheilidae, it is perhaps an extinct species of *Microborus*.

The two forms described by H. v. Ihering (1904) as *Strophocheilus chubutensis* and *S. hauthali* appear to be the only fully reliable, authentic fossil and extinct species known thus far. In their case, however, we are confronted with the problem of determining their geologic age. It is notoriously difficult to decide this for continental deposits, containing only non-marine fossils. Originally v. Ihering gave his two species as from the Lower Tertiary; but he later dated them as Upper Cretaceous. They were obtained in continental deposits known locally as the "Notostylopean Horizon." According to Ameghino's (1906, An. Mus. Nac. Buenos Aires, (3), **8**, p. 498) chronology, this horizon is part of the Guaranian Formation, which he synchronizes with the Cenomanian. At present, however, most geologists are of the opinion that the Notostylopean strata are much younger, being more probably Lower Eocene.

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[1] These deposits appear to be Upper Pliocene or possibly Pleistocene. Döring also listed from the same strata a "*Bulimus neogaeus*" which was never described and which I have tentatively included in the synonymy of *S. oblongus haemastomus*.

An additional fossil species of *Strophocheilus*, proper, from Uruguay, unfortunately of unknown geological age, is described in the sequel as *S. atavus*.

No fossil or subfossil specimens of *Gonyostomus* have been reported thus far.

Trivial Names Proposed, with Their Present Equivalents. In this revision the earliest valid name is adopted with the original spelling, except when this was formally corrected later in print by the author of the name (as in the case of *sanctae-pauli*); but adjectives have been made to agree in gender with the generic name. In this connection it should be noted that *chionostoma, leucostoma, oosomus, rhodostoma, erythrosoma, haemastomus, porphyrostoma,* and *goniostoma* are all grammatically correct, the form in *soma* or *stoma* being the noun and hence invariable, while the ending *somus* or *stomus* denotes the adjective. In determining the earliest valid name I have endeavored to establish the actual date of publication, when the name became first available to the public in print, a point which was not sufficiently considered by Pilsbry. This true date of publication follows immediately the author's name in all references given in this paper. Usually it was sufficient for the purpose to determine the year; but in a few critical cases the month or even the day were traced. In the matter of conflict of names due to homonymy, true homonyms only should be considered, namely where the same trivial name was originally proposed for different species or races in combination with the same generic name. False homonymy, due to later combinations, does not call for a change of name, except if the several forms involved are at present included in the same genus. I have listed in the synonymy all variants in spelling, whether due to deliberate emendations or to clerical or typographical errors. It is not always easy to distinguish between these and all are likely to cause confusion unless properly accounted for.

In the following alphabetical list new names proposed in the present paper are printed in **bold face**.

abbreviatus, *Strophocheilus granulosus*, J. Bequaert.
accelerans, Bulimus, v. Martens, 1867 = *S. terrestris.*
alba, Bulimus oblongus var., E. A. Smith, 1894 = *S. oblongus albescens.*
albescens, *Strophocheilus oblongus*, J. Bequaert.
albolabiata, Bulimus oblongus var., E. A. Smith, 1894 = *S. oblongus albus.*
albolabiatus, Gonyostomus turnix var., Jaeckel, 1927 = *G. turnix albolabiatus.*

albus, Bulimus oblongus var., Bland and W. G. Binney, 1872 = *S. oblongus albus.*
almeida, Strophocheilus, Spix, 1827 = *S. pudicus.*
atavus, *Strophocheilus,* J. Bequaert.
auris-virginis, Voluta, Dillwyn, 1817 = *S. pudicus.*
auritus, Bulinus, Sowerby, 1838 = *S. auritus.*
australis, Bulimus lutescens var., v. Martens, 1876 = *S. d'orbignyi.*
australis, Partula, Bowdich, 1822 = *S. pudicus.*
bridgesii, Bulimus, Pfeiffer, 1842 = *S. bridgesii.*
bronni, Bulimus, Pfeiffer, 1847 = *S. bronni.*
browni, Bulimus, H. and A. Adams, 1855 = *S. bronni.*
cacopatenis, Strophocheilus, Pilsbry, 1895 = *S.* (?) *cocapatensis.*
calus, Strophocheilus, Pilsbry, 1901 = *S. calus.*
cantagallana, Helix, Rang, 1831 = *S. terrestris.*
capillaceus, Bulimus, Pfeiffer, 1855 = *S. capillaceus.*
carnatis, Melania, Perry, 1811 = ? *S. oblongus.*
carrikeri, Strophocheilus, Pilsbry, 1930 = *S. carrikeri.*
castelnaudi, Bulimus, Hupé, 1857 = *S. leucostoma.*
castelnaui, Bulimus, v. Martens, 1876 = *S. leucostoma.*
centiquadrus, Bulimus, Ancey, 1906 = *G. turnix.*
chilensis, Bulinus, Sowerby, 1833 = *S. chilensis.*
chionostoma, Bulimus, Mörch, 1852 = *S. ovatus chionostoma.*
christiana, Helix, d'Orbigny, 1835 (*nomen nudum*).
christiani, Bulimus, Beck, 1837 (*nomen nudum*).
chubutensis, Strophocheilus, H. v. Ihering, 1904 = *S. chubutensis.*
cocapatensis, Bulimus, Pfeiffer, 1855 = *S.* (?) *cocapatensis.*
cocopatensis, Strophocheilus, Pilsbry, 1930 = *S.* (?) *cocapatensis.*
compressus, Bulimus, Beck, 1837 (*nomen nudum*).
concolor, Bulimus, Beck, 1837 (*nomen nudum*).
conicus, *Strophocheilus oblongus,* J. Bequaert.
connectens, Bulimus popelairianus var., v. Martens, 1876 = *S. popelairianus.*
contortuplicatus, Bulimus, Reeve, 1850 = *S. contortuplicatus.*
corapatensis, Bulimus, Paetel, 1889 = *S.* (?) *cocapatensis.*
cordillerae, Bulimus lutecens var., Döring, 1876 = *S. cordillerae.*
corrugatus, Bulimus, Wagner, 1827 = *S. terrestris.*
crassa, Bulimus oblongus var , Albers, 1850 = *S. oblongus haemastomus.*
crassilabris, Bulimus oblongus var., Pfeiffer, 1879 = *S. oblongus haemastomus.*
credulatus, Bulimus, G. Nevill, 1879 = *S. chilensis.*
crenellus, Bulimus, Philippi, 1867 (not in Strophocheilidae).
crenulatus, Bulimus, Pfeiffer, 1845 = *S. chilensis.*
debilis, *Strophocheilus pudicus,* J. Bequaert.
dohrnianus, Bulimus popelairianus var., v. Martens, 1876 = *S. popelairianus*
dohrniensis, Bulimus popelairianus var., Paetel, 1889 = *S. popelairianus.*
d'orbignyi, Bulimus, Döring, 1876 = *S. d'orbignyi.*
dorbignyi, Strophocheilus lutescens var., Pilsbry, 1901 = *S. d'orbignyi.*
dürfeldti, Bulimus, H. Dohrn, 1863 = *S. leucostoma.*

egregius, *Bulimus*, Pfeiffer, 1845 = *G. egregius*.
elongatus, *Strophocheilus oblongus*, J. Bequaert.
erubescens, *Bulimus*, Swainson, 1840 = *G. goniostoma*.
erubescens, *Helix*, Solander, 1786 = *S. pudicus*.
erythrosoma, *Strophocheilus*, Pilsbry, 1895 = *S. erythrosoma*.
eyerdami, *Strophocheilus sancti-pauli* J. Bequaert.
felipponei, *Strophocheilus*, H. v. Ihering, 1928 = *S. globosus*.
foreli, *Strophocheilus granulosus*, J. Bequaert.
fossilis, *Borus rimanni* var., Frenguelli, 1918 = *S. cordillerae*.
fragilior, *Strophocheilus*, H. v. Ihering, 1901 = *S. bronni fragilior*.
fulguratus, *Bulimus*, Pfeiffer, 1842 = *S. valenciennesii*.
fusoides, *Strophocheilus planidens*, J. Bequaert.
garcia-moreni, *Borus*, Miller, 1878 = *S. popelairianus*.
globosus, *Bulimus*, v. Martens, 1876 = *S. globosus*.
goniostoma, *Helix*, Férussac, 1821 = *G. goniostoma*.
gonostomus, *Bulimus*, v. Martens, 1860 = *G. goniostoma*.
grandis, *Bulimus*, v. Martens, 1885 = *S. ovatus grandis*.
granulosa, *Helix*, Rang, 1831 = *S. granulosus*.
grossus, *Bulimus*, Beck, 1837 (*nomen nudum*).
gummatus, *Bulimus*, Hidalgo, 1870 = *S. terrestris gummatus*.
haemastomus, *Bulimus*, Scopoli, 1786 = *S. oblongus haemastomus*.
hauthali, *Strophocheilus*, H. v. Ihering, 1904 = *S. hauthali*.
hector, *Bulimus*, Pfeiffer, 1857 = *S.* (?) *hector*.
hemastomus, *Bulimus*, de Roissy, 1805 = *S. oblongus*.
huascari, *Bulimus*, v. Tschudi, 1852 = *S. maximus huascari*.
hupeanus, *Bulimus*, Morelet, 1863 = *S. leucostoma*.
hybridus, *Bulimus*, Gould, 1846 = *G. egregius*.
iguapensis, *Strophocheilus milleri* var., Pilsbry, 1901 = *S. milleri iguapensis*.
iguapensis, *Strophocheilus ovatus* subsp., Maury, 1935 = *S. yporanganus*.
iheringi, *Bulimus*, Clessin, 1888 = *S. proclivis*.
imperialis, *Limnaea*, I. Lea, 1834 = *S. ovatus*.
incarum, *Megalobulimus*, Pilsbry, 1944 (not in Strophocheilidae).
indentatus, *Strophocheilus*, Da Costa, 1901 (not in Strophocheilidae).
indigens, *Strophocheilus*, Fulton, 1914 = *S. indigens*.
intercedens, *Bulimus*, v. Martens, 1876 = *S. terrestris*.
intertextus, *Strophocheilus capillaceus* var., Pilsbry, 1895 = *S. intertextus*.
jaussaudi, *Coniclus*, Lange de Morretes, 1937 = *S. planidens jaussaudi*.
jenksianus, *Strophocheilus*, Pilsbry, 1940 = *S. separabilis*.
kremnoica, *Helix*, d'Orbigny, 1835 = *S. maximus*.
kronei, *Strophocheilus milleri* var., H. v. Ihering, 1901 = *S. milleri kronei*.
lacunarum, *Bulimus*, v. Martens, 1876 = *S. leucostoma lacunosus*.
lacunosus, *Helix*, d'Orbigny, 1835 = *S. leucostoma lacunosus*.
leucostoma, *Bulinus*, Sowerby, 1835 = *S. leucostoma*.
leucostoma, *Helix pudica* var., Moricand, 1836 = *S. pudicus*.
lichtensteini, *Bulimus*, Albers, 1854 = *S. lichtensteini*.

lorentzianus, *Bulimus*, Döring, 1876 = *S. oblongus lorentzianus.*
lorenzianus, *Bulimus*, Döring, 1878 = *S. oblongus lorentzianus.*
lutecens, *Bulimus*, Döring, 1876 = *S. lutescens.*
lutescens, *Bulinus*, King and Broderip, 1832 = *S. lutescens.*
mahogani, *Bulinus*, Sowerby, 1838 = *S. leucostoma.*
major, *Bulimus rosaceus* var., d'Orbigny, 1837 = *S. rosaceus.*
martensianus, *Strophocheilus*, Pilsbry, 1902 = *S. ovatus grandis.*
mathewsii, *Bulimus*, Beck, 1837 = *S. leucostoma.*
mathieusii, *Strophocheilus*, Pilsbry, 1930 = *S. leucostoma.*
mathiusii, *Helix*, d'Orbigny, 1835 = *S. leucostoma.*
matthewsii, *Bulimus*, Pfeiffer, 1848 = *S. leucostoma.*
maxima, *Bulimus d'orbignyi* var., Döring, 1876 = *S. d'orbignyi.*
maxima, *Cochlogena*, Sowerby, 1823 = *S. maximus.*
miersi, *Strophocheilus*, Da Costa, 1904 = *S. miersi.*
miersii, *Bulinus*, Sowerby, 1838 = *G. multicolor miersii.*
milleri, *Bulinus*, Sowerby, 1838 = *S. milleri.*
minima, *Bulimus d'orbignyi* var., Döring, 1876 = *S. d'orbignyi.*
minor, *Bulimus lorentzianus* var., Döring, 1876 = *S. oblongus lorentzianus.*
minor, *Bulimus maximus* var., Troschel, 1852 = *S. maximus huascari.*
minor, *Bulimus rosaceus* var., d'Orbigny, 1837 = *S. chilensis.*
minor, *Borus oblongus* var., Ancey, 1897 = *S. oblongus lorentzianus.*
multicolor, *Helix*, Rang, 1831 = *G. multicolor.*
musculus, *Strophocheilus oblongus*, J. Bequaert.
myersii, *Bulimus*, Reeve, 1848 = *G. multicolor miersii.*
myersii, *Bulinus*, Sowerby, 1838 = *S. pudicus.*
nana, *Bulimus proximus* var., v. Martens, 1860 = ? *S. maximus huascari.*
neogaeus, *Bulimus*, Döring, 1884 = ? *S. oblongus haemastomus.*
nucleus, *Bulinus*, Sowerby, 1833 = *S. lutescens.*
oblonga, *Helix*, O. F. Müller, 1774 = *S. oblongus.*
occidua, *Bulla*, G. Shaw, 1797 = *S. oblongus.*
oliveirai, *Strophocheilus terrestris*, J. Bequaert.
oosomus, *Strophocheilus*, Pilsbry, 1895 = *S. terrestris oosomus.*
orbignyi, *Borus*, Petit, 1883 = *S. d'orbignyi.*
ovalis, *Helix*, Gmelin, 1790 = *S. ovatus.*
ovalis, *Helix*, Wood, 1818 = *S. oblongus.*
ovata, *Helix*, O. F. Müller, 1774 = *S. ovatus.*
ovipara, *Helix*, Solander, 1786 (two names) = *S. oblongus* and *S. ovatus.*
ovum, *Bulimus*, H. and A. Adams, 1855 = *S. ovatus.*
ovum, *Helix*, Férussac, 1821 = ? *S. ovatus.*
pachycheilus, *Bulimus*, Reeve, 1848 = *S. pachychilus.*
pachychilus, *Bulimus*, Pfeiffer, 1842 = *S. pachychilus.*
papyraceus, *Limnaeus*, Spix, 1827 = *G. goniostoma.*
paranaguensis, *Strophocheilus*, Pilsbry and H. v. Ihering, 1900 = *S. granulosus paranaguensis.*
particeps, *Strophocheilus rosaceus* var., Fulton, 1936 = *S. rosaceus.*

perelongatus, *Strophocheilus oblongus*, J. Bequaert.
pergranulatus, *Strophocheilus bronni* var., Pilsbry, 1901 = *S. bronni pergranulatus.*
perplexus, *Bulinus*, Sowerby, 1841 = *S. pudicus.*
pilsbryi, *Strophocheilus*, H. v. Ihering, 1900 = *S. pilsbryi.*
planidens, *Bulimus*, Michelin, 1831 = *S. planidens.*
popelairiana, *Bulimus*, Nyst, 1845 = *S. popelairianus.*
popolairianus, *Strophocheilus*, Herm. Daniel, 1942 = *S. popelairianus.*
porphyrostoma, *Strophocheilus*, Clench and Archer, 1930 = *S. erythrosoma.*
potiezi, *Bulimus*, Mörch, 1857 = *S. rosaceus.*
proclivis, *Bulimus*, v. Martens, 1888 = *S. proclivis.*
proximus, *Bulinus*, Sowerby, 1838 = *S. terrestris.*
pudica, *Helix*, O. F. Müller, 1774 = *S. pudicus.*
pygmaeus, *Strophocheilus sanctipauli*, J. Bequaert.
rhodocheilus, *Bulimus*, Reeve, 1848 (not in Strophocheilidae).
rhodochilus, *Bulimus*, v. Martens, 1860 (not in Strophocheilidae).
rhodostoma, *Helix pudica* var., Moricand, 1836 = *S. calus.*
rimanni, *Borus*, Frenguelli, 1918 = *S. rosaceus.*
rosaceus, *Bulinus*, King and Broderip, 1832 = *S. rosaceus.*
rosaceus, *Otis*, Férussac, 1821 = *S. pudicus.*
rosasceus, *Bulinus*, Sowerby, 1833 = *S. rosaceus.*
rosea, *Ampullaria*, Spix, 1827 = *S. oblongus.*
roseolabris, *Strophocheilus pudicus*, J. Bequaert.
roseus, *Bulimus*, de Montfort, 1810 = *S. oblongus.*
rugosus, *Strophocheilus*, Fulton, 1905 = *S. leucostoma lacunosus.*
sancta-cruzii, *Bulimus*, H. and A. Adams, 1855 = *S. santa-cruzii.*
sanctae-catharinae, *Bulimus haemastomus* var., Lesson, 1831 = *S. granulosus.*
sanctae-crucis, *Bulimus*, v. Martens, 1867 = *S. maximus huascari.*
sanctaepauli, *Strophocheilus oblongus* var., H. v. Ihering and Pilsbry, 1901 = *S. sanctipauli.*
sancti-josephi, *Strophocheilus*, Maury, 1935 = *S. sancti-josephi.*
sanctipauli, *Strophocheilus*, Pilsbry, 1902 = *S. sanctipauli.*
santacruzensis, *Bulimus*, Pfeiffer, 1868 = *S. santa-cruzii.*
santa-cruzii, *Helix*, d'Orbigny, 1835 = *S. santa-cruzii.*
semilineata, *Helix*, Menke, 1828 = *S. oblongus.*
semimalleatus, *Strophocheilus*, Fulton, 1905 = *S. lichtensteini semimalleatus.*
seneri, *Borus*, Jousseaume, 1884 = *S. rosaceus seneri.*
separabilis, *Strophocheilus*, Fulton, 1903 = *S. separabilis.*
sinistralis, *Bulimus lacunosus* form, Blume, 1920 = *S. leucostoma.*
squammulatus, *Bulimus*, A. and J. B. Villa, 1841 = *S. chilensis.*
st.-crucis, *Bulimus*, Beck, 1837 = *S. santa-cruzii.*
subhybridus, *Goniostomus*, Da Costa, 1906 (not in Strophocheilidae).
terrestris, *Bulimus*, Spix, 1827 = *S. terrestris.*
thammianus, *Bulimus popelairianus* var., v. Martens, 1876 = *S. popelairianus.*
tobagoensis, *Strophocheilus oblongus* var., Pilsbry, 1895 = *S. oblongus albus.*

topelairianus, Bulimus, Troschel, 1877 = *S. popelairianus.*
toriii, Megalobulimus, Lange de Morretes, 1937 = *S. yporanganus toriii.*
turnix, Bulimus, Gould, 1846 = *G. turnix.*
unidentata, Partula, Sowerby, 1825 = *S. unidentatus.*
valenciennesii, Bulimus, Pfeiffer, 1842 = *S. valenciennesii.*
valenciennnensi, Corus, Jousseaume, 1877 = *S. valenciennesii.*
valensiennesi, Bulimus, Jay, 1850 = *S. valenciennesii.*
vaporeus, Bulimus, Mousson, 1870 = *S. oblongus.*
versatilis, Strophocheilus, Fulton, 1905 = *S. auritus.*
versicolor, Bulimus, de Cristofori and Jan, 1832 = *G.* (?) *versicolor.*
vestitus, Strophocheilus kremnoicus subsp., Pilsbry, 1926 = *S. maximus vestitus.*
virgineus, Bulimus, Bruguière, 1791 = *S. pudicus.*
yporanganus, Strophocheilus, H. v. Ihering and Pilsbry, 1901 = *S. yporanganus.*

Genus STROPHOCHEILUS Spix

Characters. Shell medium-sized to very large (20 to 160 mm. long), capacious, ovate-oblong, broadly elliptical or spindle-shaped, rather wide in proportion to the length, but always longer than greatest diameter, with very large body-whorl and bluntly pointed or rounded apex. Periostracum thin or moderately thick, often evanescent, uniformly colored or with lighter and darker vertical streaks, sometimes with faint spiral lighter zones, particularly below the suture. Aperture large, as a rule higher than wide, long-ovate, broadly ovate or semi-elliptical, vertical or more or less oblique. Columella with or without fold. Umbilicus as a rule very narrow and slit-like, sometimes completely closed, rarely perforate or moderately open. Outer lip usually expanded, with a broad rim, the edge more or less thickened and frequently accrescent in old age, rarely obtuse and simple, always evenly arched at the base. Nepionic shell (formed within the egg) unusually large, of several (3 to 3½) whorls, when unworn mostly covered with a characteristic sculpture of vertical riblets (sometimes decussated), spiral engraved striae or raised spiral lines, sometimes also granulose. Post-nepionic whorls with or without granulation or minute wavy vertical sculpture.

The animal is known as yet for very few species of the subgenera *Strophocheilus,* proper, *Megalobulimus, Microborus* and *Chiliborus*: *S. pudicus* (Moricand, 1836); *S. oblongus* (Lister, 1699; Guilding, 1826; J. D. Dean, 1928; Martins, 1945) and its subsp. *lorentzianus* (María J. H. Scott, 1939); *S. ovatus* (Rang, 1831; Férussac, 1832; Martins, 1945) and its subsp. *chionostoma* (Férussac, 1827; Deshayes, 1866, as *cantagallanus*); *S. maximus* (d'Orbigny, 1837, as *kremnoicus*) and its subsp. *huascari* (Tschudi, 1852); *S. bronni* (Mawe, 1812, as *H. ovalis* var.); *S. granulosus* (Lesson, 1832, as *haemastomus* "variété granuleuse"); *S. intertextus* (?d'Orbigny, 1837, as *oblongus* var.); *S. d'orbignyi* (Döring, 1881); and *S. rosaceus* (King and Broderip, 1832; d'Orbigny, 1837). It is always very large, completely retractile within the shell, with a broad foot, undivided ventrally, and with four tentacles, of which the hind pair is the longer and bears the eyes. The animal of *S. pudicus* was incompletely described by Moricand as bluish-gray above, white beneath, with four tentacles, of which the two largest measure one inch in length. In the species of *Megalobulimus* for which the animal is known, the upper surface of the foot bears dorsally more or less longitudinal rows of warts or lengthened tubercles, while the sides are divided fairly regularly by deep vertical or oblique grooves, the intervening ridges being irregularly cut up into warts by shallower longitudinal folds. Férussac figures all four tentacles of *S. ovatus* as rugulose, with minute warts, and, to judge from Deshayes' figure, this seems to be true also for the subsp. *chionostoma*. In *S. oblongus* the eye-bearing tentacles are superficially reticulate, as they are also in *S. maximus*, according to d'Orbigny, and in *S. granulosus*, according to Lesson. The animal of *S. ovatus* is dirty-gray, almost brownish, with darker tentacles (Rang); while Deshayes describes that of subsp. *chionostoma* as uniformly pale gray, with a bistre tinge and paler toward the margin of the foot. In *S. oblongus* it is also yellowish-gray or dirty-gray, more brownish anteriorly, with bluish tentacles.[1] That of *S. maximus* is uniformly dirty yellowish-brown (d'Orbigny); while in *S. maximus huascari* it is described as blackish-brown with yellowish-brown spots (Tschudi). According to Lesson, it is pale red, slightly orange in *S. granulosus*. In the subgenus *Chiliborus*, the animal of *S. rosaceus* is strikingly different, to judge from the published figures. d'Orbigny describes it as follows: "thick, shortened, bluish, covered on the entire neck with oval tubercles and longitudinally of a beautiful vermilion-red; other smaller tubercles cover the sides of the mouth above, as well as the upper side of the two pairs of ocular tentacles to near their tips. The tubercles on the upper side of the foot are much larger than the others and those nearest the margin form as it were a lengthened horse-shoe with the convexity turned toward the margin." The figure shows all the tubercles bright vermilion-red on a bluish-gray or ash-colored surface. Although Döring saw the animal of *S. d'orbignyi*, of the subgenus *Microborus*, he did not describe it.

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[1] Specimens of *S. oblongus albus* were observed alive at the M.C.Z. for several weeks. The animal is very pale, dirty white.

Jaw and radula are known only for two species, both of the subgenus *Megalobulimus*: *S. oblongus* (typical: Troschel, 1848 and 1849, as *haemastomus*; Mörch, 1865; Heynemann, 1868; Semper, 1874; subsp. *lorentzianus*: María J. H. Scott, 1939; subsp. *albus*: Bland and Binney, 1872); and *S. ovatus* (typical: Mörch, 1865; subsp. *chionostoma*: Crosse and Fischer, 1876, as *cantagallanus*). In addition, Döring (1881) described the jaw of *S. d'orbignyi* and *S. cordillerae*, of the subgenus *Microborus*. The anatomy is known, more or less completely, for four species, all *Megalobulimus*: *S. oblongus* (typical form: Guppy, 1866; Semper, 1874; and Simroth, 1894; H. v. Ihering, 1884 and 1891; H. B. Baker, 1926; subsp. *lorentzianus*: María J. H. Scott, 1939); *S. ovatus* (subsp. *chionostoma*: Crosse and Fischer, 1875, as *cantagallanus*; typical form: Plate, 1896); *S. terrestris* (Plate, 1896, as *proximus*); and *S. maximus* (Semper and Simroth, 1894). The most complete accounts are those of H. B. Baker and María J. H. Scott.

The thick-shelled egg is elongate elliptical, with flattened sides and broadly rounded, similar ends. Its size is in proportion to that of the snail, being largest for *S. popelairianus* (up to 51 mm.), which has the largest known egg of any living terrestrial mollusk. It is only 7.8 to 9 mm. long in *S. lutescens*. Eggs are known for species of all subgenera (including the genotype, *S. pudicus*). Turpin (1832) found that the lime of the eggshell of *S. oblongus* is deposited as amorphous particles, not as crystals.

Ethology. All *Strophocheilus* are strictly terrestrial snails, so far as observed.[1] Most of them prefer well-sheltered, damp, deeply shaded places, densely covered with vegetation, such as ravines in virgin forests. They appear to be nocturnal, hiding under humus or in loose soil during the day. At times of drought they bury deep down in the ground or crawl into crevices of rocks or in caves, where they estivate after closing the aperture with an epiphragm.[2] Following the large-scale destruction of forests in certain sections of Brazil, some of the species have now become very scarce or possibly even extinct. The Chilean species of *Chiliborus* are said to hide underneath rocks or in loose sand, and evidently occur in a more xerophytic environment than most other species of the genus. *Microborus* also probably lives under relatively drier conditions. The common *S. oblongus* is evidently more adaptable to changes in the environment than the other species. It seems to have become closely associated with man, being often common in gardens, cultivated or fallow land, second-growth woods and other man-made surroundings. Accidental or intentional introduction by man explains its occurrence in some of the Antilles, and even on the continent some of the area it now occupies may be due to the same agency.

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[1] v. Martens (1876) gives Tschudi as the authority for the statement that *S. maximus huascari* was found on trees. This was by oversight, as Tschudi (1852) states expressly that he never found *huascari* on trees or rocks. Férussac (1827) claims that *S. ovatus chionostoma* climbs trees, but this was not based on personal observation and was never confirmed.

[2] These estivating habits are similar to those of the African achatinid genus *Burtoa*, which resembles *Strophocheilus* in shape.

Several of the larger species were formerly commonly eaten by the native Indians, as noted by the early travellers for *S. oblongus, S. popelairianus,* and *S. ovatus.* As late as 1867, v. Martens found *S. ovatus* offered for sale as food in the market at Rio de Janeiro. Miller in 1879 noted that *S. popelairianus* was regarded as a delicacy in Ecuador. In recent years the custom of eating these snails seems to have been discontinued in most regions. The empty shells also sometimes serve various household or ornamental purposes. L. B. Brown (1903) noted an interesting use of the egg of *S. oblongus* in Barbados, where the white provides glue to mend china and glass and is claimed to be superior for this end to any manufactured product.

Excluded Species. The following four *nomina nuda* may have been based on *Strophocheilus,* but have no standing in nomenclature.

Helix (*Cochlogena*) *christiana* "Férussac" d'Orbigny, 1835, Mag. Zool., **5**, Class V, No. 61, p. 15; said by d'Orbigny to be related to his *H.* (*C.*) *kremnoica* (= *S. maximus* Sowerby). He probably saw the name on a label at the Paris Museum.

Bulimus (*Bulimus*) *christiani* Beck, 1837, Index Moll., pt. 1, p. 52 (interior of Brazil).

Bulimus (*Bulimus*) *grossus* Beck, 1837, *Op. cit.,* pt. 1, p. 53 (interior of Brazil).

Bulimus (*Bulimus*) *compressus* Beck, 1837, *Op. cit.,* pt. 1, p. 53 (interior of Brazil).

Bulimus crenellus Philippi (1867). Philippi originally compared this species with *B. crenulatus* Pfeiffer (= *S. chilensis* Sowerby), which may have induced subsequent authors to refer it to *Strophocheilus,* where it remained unrecognized. It clearly belongs in Bulimulidae. The species is discussed further under *Microborus,* as I believe that it was redescribed by Pilsbry as *Megalobulimus incarum.*

Bulimus rhodocheilus Reeve (1848) was placed by Pilsbry (1895) in the subgenus *Strophocheilus,* proper. It seemed to him "most nearly allied to *S. planidens.*" The color pattern and sculpture, however, do not agree well with this allocation. I was at first inclined to refer the species tentatively to *Gonyostomus*; but a careful study of the figure makes it more probably a *Dryptus.* It should be noted that Pfeiffer's description (1853, Monogr. Helic. Viv., **3**, p. 315), translated by Pilsbry (1895, Man. of Conch., (2), **10**, p. 8), differs somewhat from Reeve's original account. Pfeiffer redescribed a shell from the Cuming Collection, probably Reeve's type, which is now at the British Museum. Major M. Connolly (1946) has recently examined this type and writes that it "is perfectly figured by Reeve. The nepionic whorls seem completely sculptureless, but their epidermis has peeled off. I do not detect any sign of spiral or transverse scupture, but later whorls (from the third onward) bear exceedingly fine, minute granular sculpture." This information suffices to exclude the species from Strophocheilidae.

C. F. Ancey (1904, Jl. de Conchyl., **52**, pp. 300, 301 and 314) referred *Bulimus mabillei* Crosse (1867), *Plecochilus dalmasi* Dautzenberg (1900), and *Euritus argenteus* Jousseaume (1900) to *Strophocheilus*. All three belong, however, to *Plekocheilus* in the family Bulimulidae.

Strophocheilus (*Dryptus*) *indentatus* Da Costa, 1901, Proc. Mal. Soc. London, **4**, pt. 6, p. 239; Pl. 24, fig. 8 (Ecuador), does not belong in Strophocheilidae.

Synopsis of Subgenera

1. Subgenus *Strophocheilus*, proper. Nepionic whorls mostly with a vertical sculpture of regular riblets, without granulation; later whorls with or without minute spiral, wavy striation, sometimes in part vertically ribbed or malleated. Shell medium-sized, 40 to 70 mm. long, ovate-oblong or spindle-shaped, markedly flattened from front to back. Columella with or without fold. Outer lip with reflexed rim.

2. Subgenus *Speironepion*, new. Nepionic whorls mostly with fine, crowded, spiral striae; later whorls with finely beaded, spiral rows of granules. Shell medium-sized, 47 to 71 mm. long, ovate-oblong, markedly flattened from front to back. Columella without fold. Outer lip flaring, with reflexed rim. Type by present designation: *Bulinus milleri* Sowerby, 1838.

3. Subgenus *Megalobulimus*. Nepionic whorls mostly with a vertical sculpture of complete or incomplete, more or less spaced riblets or folds, often also minutely granulose; later whorls either smooth, or granulose, or malleated, or vertically striate or ribbed. Shell often large, 50 to 160 mm. long, broadly ovate, as a rule moderately flattened from front to back. Columella without or with a mere trace of a fold. outer lip thick, little or not reflexed, often accrescent in old age.

4. Subgenus *Microborus*. Nepionic whorls mostly with fine, vertical raised lines decussated by spiral engraved lines into granules; later

whorls also with minute granulation. Shell relatively small, 23 to 36 mm. long, elongate elliptical to broadly elliptical, scarcely flattened dorso-ventrally, with broadly rounded and depressed summit. Columella without fold. Outer lip thick, little or not reflexed, sometimes accrescent in old age.

5. Subgenus *Chiliborus.* Nepionic whorls entirely covered with very fine raised spiral lines; later whorls with strong or weak growth-wrinkles and distinct or obsolete granulation. Shell medium-sized to small, 19 to 67 mm. long, not flattened dorso-ventrally, subglobose-ovate to elongate-ovate. Columella without fold. Outer lip thick, reflexed, often accrescent in old age.

Subgenus STROPHOCHEILUS, proper

Strophocheilus Spix, 1827, in Wagner, Test. Fluv. Brasiliam, Pl. 11 and p. 12 (no description; in the combinations *Strophocheilus haemastomus* Spix and *Strophocheilus almeida* Spix, the latter defined by the figure and synonymy). Type by designation of G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 122: *Strophocheilus almeida* Spix, 1827 (=*Helix pudica* O. F. Müller, 1774).

Strophochilus Agassiz, 1846, Nomenclat. Zool., Index Universalis, p. 355 (emendation of *Strophocheilus* Spix). Type by designation of v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191: "*Bulimus almeida* Spix", 1827 (=*Helix pudica* O. F. Müller, 1774). Thiele, 1931, Handbuch System. Weichtierk., **2**, p. 650.

Bulimus subg. *Coniclus* Albers, 1850, Die Heliceen, p. 147 (with description; for 4 described species). Type by designation of L. Pfeiffer, 1850, Zeitschr. f. Malak., **7**, p. 98: *Helix pudica* O. F. Müller, 1774, one of the species originally included.

Otis "Humphreys" Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 66 (or 70) (in the combination *Otis rosaceus* Humphreys, as a synonym of *Partula pudica;* without description). Not of Linnaeus, 1758.

Stropocheilus H. v. Ihering, 1929, Abhandl. Arch. Molluskenk., **2**, pt. 2, p. 18 (typographical error for *Strophocheilus*).

Strophocheilus, proper, is restricted to southeastern Brazil (Bahia, Minas Geraes, Rio de Janeiro, São Paulo, Paraná, Santa Catharina, and Rio Grande do Sul).

Synopsis of Species

A. Periostracum and superficial surface of shell without minute spiral striation. Shell malleated or with anastomosing rugosities over the last two whorls. Columella with a more or less developed fold. Basal third of body-whorl either narrowly tapering to the left of the columella or very slightly saccate. Parietal wall as a rule about as long as columella or slightly shorter.

1. Columellar fold slight to medium, not set off by an oblique depression from the umbilical edge. Upper suture of body-whorl in front view scarcely more oblique than preceding suture. Shell ovate-oblong in outline. *S. pudicus*, with subsp. *roseolabris* and subsp. *debilis*.

2. Columellar fold strong, forming a broad, rounded ridge set off by an oblique depression from the umbilical edge. Upper suture of body-whorl in front view as a rule markedly more slanting than preceding suture. Shell ovate-oblong in outline. *S. calus*.

3. Similar to *S. calus*, but relatively more slender, with a higher and broader spire. Body-whorl with an impressed subsutural line. Columellar area with a depression as in *calus*. *S. contortuplicatus*.

4. Columellar fold thin and narrow, not set off by a depression from the umbilical edge. Umbilicus completely closed. Body-whorl with an impressed subsutural line. Shell thin and light, regularly spindle-shaped; base of body-whorl and penultimate whorl more swollen than in either *pudicus* and *calus*, somewhat saccate. *S. miersi*.

B. Periostracum and superficial texture of shell with exceedingly fine, but regular, crowded, wavy, spiral striolae over post-nepionic whorls. Columella without fold. Base of body-whorl swollen to the left of the columella, saccate.

5. Body-whorl even or with very weak growth-striae, rarely slightly malleated. Parietal wall usually shorter than columella, rarely of about the same length. Upper area of body-whorl strongly depressed behind the parietal edge of the outer lip. Inner edge of outer lip eventually producing an elongate tooth, usually longer than high, placed about mid-height (not developed in the only specimen known of subsp. *fusoides*). Umbilicus variable, usually slit-like, openly rimate or perforate, more rarely very narrow or closed. Shell regularly spindle-shaped. *S. planidens*, with subsp. *jaussaudi* and subsp. *fusoides*.

6. Body-whorl finely malleated. Aperture rather broad, semi-elliptical; outer lip eventually producing a nodulose tooth, usually nearly as high as long, placed about mid-height on the inner edge. Parietal wall as long as or longer than columella. Upper area of body-whorl moderately depressed behind the parietal edge of the outer lip. Umbilicus narrowly rimate or nearly closed. Shell elongate-ovate. *S. unidentatus*.

7. Body-whorl more or less malleated, with slight vertical folds irregularly decussated by some of the deeper spiral striae. Aperture rather narrow, pear-shaped; inner margin of outer lip always without tooth (as far as known). Parietal wall as long as or longer than columella. Upper area of body-whorl moderately depressed behind the parietal edge of the outer lip. Umbilicus completely closed. Shell regularly spindle-shaped. *S. erythrosoma.*

STROPHOCHEILUS (STROPHOCHEILUS) PUDICUS (O. F. Müller)

a. Typical PUDICUS

Pl. 4, fig. 4; Pl. 8, fig. 5; Pl. 9, fig. 4; Pl. 16, fig. 3; Pl. 19, fig. 1

[Lister, 1685, Synopsis Method. Conchyl. Liber Primus, Pl. 24, fig. 22 ("Ind. Or.")].

Helix pudica O. F. Müller, 1774, Verm. Terr. Fluv. Hist., **2**, p. 97 ("in Museo Spengleriano"; no locality; with description). Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., **1**, pt. 6, p. 3645.

[Chemnitz, 1786, Syst. Conch. Cab., **9**, pt. 2, p. 44; Pl. 121, fig. 1042 (2 views of Müller's type, "ex Museo Spengleriano"; with a reference to *Helix pudica;* said to be from the East Indies)].

Partula pudica Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 66 (or p. 70). J. E. Gray, 1825, Ann. of Philos., (N. S.), **9**, p. 415. Sowerby, 1825, Cat. Shells Earl Tankerville, p. 40. Potiez and Michaud, 1838, Gal. Moll. Douai, **1**, p. 198; Pl. 20, figs. 7–8. A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 23. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 163.

Helix (*Cochlogena*) *pudica* Moricand, 1836, Mém. Soc. Phys. Hist. Nat. Genève, **7**, pt. 2, p. 438 (Brazil: Bahia. Egg; animal. In part: var. *leucostoma* Moricand only).

Bulimus (*Bulimus*?) *pudicus* Beck, 1837, Index Moll., pt. 1, p. 53.

Bulimus pudicus Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 253. Jay, 1839, Cat. Shells Coll., 3d Ed., p. 56. Pfeiffer, 1840, Krit. Register Konch.–Kab., p. 85. Küster, 1841, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 19; Pl. 4, figs. 7–8 (after Chemnitz); Pl. 22, fig. 3 (Brazil: Bahia). Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 120. Deshayes, 1844, in Lamarck, Hist. Nat. Anim. Sans Vert., 3d Ed., **3**, p. 359. Porro, 1846, Coll. Mus. Mediol., Moll. Terr. Fluv., p. 14. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 53. d'Orbigny, 1849, Dict. Univ. Hist. Nat., Atlas, **3**, Moll., Pl. 20, figs. 5–6 (name on p. 7 of Expl. of Plates). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 206. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 30 (in part: white-lipped shells only); Atlas, Pl. 143, figs. 11 and 13 (Expl. of Plates, p. 20); 1853, Traité Elém. Conchyl., Atlas, Pl. 84, fig. 3 (Expl. of Plates, p. 53). Pfeiffer, 1853, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. viii; 1853, Monogr. Helic. Viv., **3**, p. 315. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 28. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 378 (in part: the references, not the description). A. D. Brown, 1861, Cat. Shells Coll., p. 48; 1866, *Op. cit.*, 2d Ed., p. 60. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 22. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 33. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 216.

Bulimus (*Partula*) *pudica* Anton, 1839, Verzeichniss Conchyl. Samml., p. 40.

Bulimus (*Coniclus*) *pudicus* Albers, 1850, Die Heliceen, p. 147. Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 28.

Bulimus (*Strophocheilus*) *pudicus* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 147. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 150. Chenu, 1859, Man. Conchyl., **1**, p. 435, fig. 3202. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 223. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119.

Bulimus (*Strophochilus*) *pudicus* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191.

Bulimus (*Dryptus*) *pudicus* G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 122.

Strophocheilus (*Strophocheilus*) *pudicus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 6; Pl. 19, figs. 37 (specimen) and 38 (after Reeve); 1901, *Op. cit.*, (2), **14**, p. 116; Pl. 17 figs. 39–40 (after Chemnitz) and 41 (specimen); 1902, *Op. cit.*, (2), **14**, Classification, p. iv. Haas, 1939, Senckenbergiana, **21**, p. 269 (Brazil: Campina Grande, Est. Parahyba).

Helix erubescens Solander, 1786, Cat. Portland Mus., p. 187 (with reference to Lister's Pl. 24, fig. 22; no description; no locality). See W. H. Dall, 1921, The Nautilus, **34**, p. 127.

Bulimus virgineus Bruguière, 1791, Encyclop. Méthod., Vers., **1**, pt. 1, p. 315 (no locality; new name for *Helix pudica* Müller, cited as a synonym; also with reference to Chemnitz' fig. 1042). Wagner, 1827, in Spix, Test. Fluv. Brasiliam, p. 12; Pl. 11, figs. 2–3 (Brazil: Est. Bahia).

Ellobium virgineum Röding, 1798, Museum Boltenianum, pt. 2, p. 106 (with reference to *Helix pudica* Gmelin and to Chemnitz' fig. 1042); 1819, *Op. cit.*, 2d Ed. (by J. Noodt), p. 75.

Voluta auris-virginis Dillwyn, 1817, Descr. Cat. Rec. Shells, **1**, p. 502 (new name for *Helix pudica* Müller, cited as a synonym).

Otis rosaceus [Humphreys, 1797, Museum Calonnianum, p. 62; ruled as not acceptable in nomenclature] Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 66 (or 70) (as a synonym of *Partula pudica* Müller).

Partula australis Bowdich, 1822, Elements of Conchology, Pl. 8, fig. 30 (no description; no locality; name in Expl. of Plate).

Strophocheilus almeida Spix, 1827, in Wagner, Test. Fluv. Brasiliam, Pl. 11, figs. 2–3 (with name), and p. 12 (as a synonym of *Bulimus virgineus* Bruguière).

Bulimus almeida Pfeiffer, 1859, Monogr. Helic. Viv., 4, p. 377; 1868, *Op. cit.*, **6**,

p. 22. Haines, 1868, Cat. Terr. Shells Coll., p. 43. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 33. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 208. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), p. 124.

Strophochilus almeida Bland, 1866, Amer. Jl. Conch., **2**, p. 356.

Bulimus (*Strophocheilus*) *almeida* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 223.

Bulimus (*Strophochilus*) *almeida* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191.

Bulinus myersii Sowerby, 1838 (October 31), Conchol. Illustr., *Bulinus*, fig. 98 of pt. 145 (name in accompanying printed list; no description; no locality). Not *Bulinus miersii* Sowerby, 1838, *Op. cit.*, fig. 90 of pt. 144, which appeared before October 31.

Bulinus perplexus Sowerby, 1841, Conchol. Illustr., *Bulinus*, p. 8 of Revised Index of Figures (new name for fig. 98 of pt. 145 called in 1838 *Bulinus myersii*).

Bulimus perplexus Jay, 1850, Cat. Shells Coll., 4th Ed., p. 205.

Bulimus (*Coniclus*) *perplexus* Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 28.

Bulimus (*Strophocheilus*) *perplexus* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 147.

Müller's type of *pudica*, figured by Chemnitz, should be looked for in the Copenhagen Museum. Bruguière saw no specimen and his *virgineus* was based only on Müller's description and Chemnitz' figure. Dillwyn's *auris-virginis* is merely a new name for *pudica* and had no type. The specimens on which Solander's *erubescens* and Bowdich's *australis* were based are lost. The type of Spix' *almeida* may be in Munich. That of Sowerby's *myersii* (= *perplexus*) cannot now be located at the British Museum (M. Connolly, *in litt.*, 1946). Several cotypes of *H. pudica* var. *leucostoma* Moricand are now at the Geneva Museum. Dr. G. Mermod has recently presented some of them to the M.C.Z. (No. 175519). All the foregoing names were based on white-lipped shells.

Although Müller's type was never critically examined since Chemnitz' time, I agree with Pilsbry's conclusions regarding the proper use of the name for the white-lipped form of the common species of northeastern Brazil, which lacks spiral striation on the periostracum. The shape of the left side of the body-whorl (in front view), especially at the base, and of the columellar margin of the mouth, as shown in Chemnitz' figure, seem particularly conclusive. Moreover, Müller states: "Centrum axis sub labro perforatum," which does not apply to any specimen of *S. erythrosoma* I have seen. The outer lip and columella are white in the typical form, as originally described by Müller, his statement "labrum adnatum roseo flavescens" referring to the parietal wall, where the pinkish hue of the body-whorl shows through the glazing. In the material seen the white-lipped specimens far outnumber the others.

Specimens Examined. Brazil: many without more definite locality or labelled "Bahia" (M.C.Z.; M.U.Mich.; A.N.S.Phila.; M.N.H.Chic.; A.M.N.H.; U.S.N.M.) Rio Gregugy, Est. Bahia, 1 specimen (H. M. Curran. — U.S.N.M.).

The species was originally believed to be East Indian, until Spix collected it in the state of Bahia, in 1817–1820. Haas (1939) records it from the state of Parahyba. Although common in collections, few specimens bear a definite locality, so that its true range is at present scarcely known. Albers (1850) and Paetel (1873) list it as from Rio de Janeiro, but there is no reliable evidence that it occurs in that area.

The egg was described by Moricand (1836) as oval, slightly tapering at both ends, hard, white and shiny, 14 to 16 mm. long and 9 to 10 mm. wide.

The original (Danish) measurements given by Müller for his *H. pudica* were: "long. 20 lin. [= 43.6 mm.], lat. 9 lin. [= 19.6 mm.]." The figure of the type in Chemnitz is, however, 47 mm. long, 24 mm. wide, the aperture 26 by 10 mm. Spix' figure of *S. almeida* measures (in mm.); length, 59; greatest width, 31; the aperture 37 by 13. Sowerby's figure of *B. myersii* (= *B. perplexus*) is 55 mm. long, 30 mm. wide, the aperture 31 by 13 mm. Pilsbry mentions specimens respectively 48.5 and 60 mm. long, 23 and 31 mm. wide.

It may be noted that the smallest specimen seen approaches closely the size of Chemnitz' figure.

Measurements of Adult Shells

Length	Width in front view	Width in Profile	Aperture		Whorls	
			Length	Width		
61 mm.	31	23.5	38	13.5	5½	Brazil
60	32	25.5	37.5	14	5½	Rio Gregugy
58.5	29	23.5	36	12	5⅓	Bahia
58	32	24	37	13	5⅓	"
56	26.5	23	35	12	5⅓	"
53.5	29	23	34.5	12.5	5⅓	"
53	31	24.5	34.5	13	5⅓	"
52.5	25	22	30	11	5⅓	"
51.5	29	22.5	32.5	11.5	5⅓	"
50.5	23.5	20.5	30	9	4½	Brazil
50	24.5	21	32	11.5	4½	"

Original description of *H. pudica*: "Helix testa oblonga, rugulosa, rosacea, apertura edentula; labro dilatato, candido. Testa ovato-acuminata, nitida ex candido et roseo mixta, rugulis minutissimis ubique vestita. Anfractus vix sex, extimus quinis vicino et reliquis simul sumtis major. Faux alba; apertura ovato-oblonga; labrum adnatum roseo-flavescens. Centrum axis sub labro perforatum."

Original description of *S. almeida*: "B. testa ovato-oblonga, crassa, rugulosa, ventricosa, perforata; rosea; apertura oblonga; peristomate incrassato, repando-reflexo, albo. Testa ovato-oblonga, ventricosa, crassa, scrobiculata, irregulariter rugulosa, epidermide tenui vestita. Anfractus sex ventricosi, ultimus amplissimus, spira fere triplo major. Spira inflato-conica, apice obtusa; anfractus penultimus caeteris spirae gyris fere duplo major; anfractus tertius et quartus longitudinaliter subtilissime striati; apex laevis. Apertura ovato-oblonga, laevissima, nitida, subauriformis. Labrum incrassatum, glabrum, repando-reflexum; margine exteriore, acuto, libero, replicato; margine sinistro et interiore apud columellam plicam valde obliquam formante. Rima umbilicaris longitudinalis, angusta. Color testae roseus; epidermis rubro-fusca aut fusco-olivacea. Apertura alba."

b. S. PUDICUS ROSEOLABRIS, new subspecies

Pl. 3, fig. 3; Pl. 24, fig. 3

Bulimus pudicus Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 30 (in part: pink-lipped shells only); Atlas, Pl. 143, fig. 12 (Expl. of Plates, p. 20).

Several other authors cite white-lipped and pink-lipped specimens of *pudicus*, but their pink-lipped specimens were mostly either *S. calus* or *S. erythrosoma*. Deshayes (1851) even stated that the aperture was "usually tinged with beautiful purplish rose," adding that there is a constant variety with white aperture. This is clearly incorrect, as Müller originally described the white-lipped shell. Moreover, the white-lipped form is the common one in collections. Of some 85 specimens seen, only three have a more or less pinkish or violaceous lip; but in every other respect these shells are like typical *pudicus*.

Shape, size and sculpture of typical *S. pudicus*. Of the same general color, but outer lip, columella and glazed surface of parietal wall pale vinaceous pink.

It would be interesting to know whether white-lipped and pink-lipped specimens occur in the same colony.

Specimens Examined. Brazil: Bahia, holotype (M.C.Z. No. 177681) and two paratypes (D.Z.S.P. No. 3224 and M.C.Z. No. 179288).

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
56 mm.	30	25	36.5	13.5	5⅛	Bahia, holotype
47.5	26	21	28.5	12	5	" , paratype
46	25.5	20	27.5	11.5	5	" , "

c. S. pudicus debilis, new subspecies

Pl. 16, fig. 1; Pl. 17, fig. 2

Shape and sculpture of typical *pudicus,* with the same auriform aperture and strongly flaring outer lip. Differs markedly in the reduced size, narrow outline and relatively shorter aperture, which is only about one-half of the total length. Parietal wall slightly shorter than columella. Umbilical slit more broadly open than in any typical *pudicus* seen. Outer lip and columella pale rose. The specimen was collected dead, but retained some patches of periostracum, showing that it is not subfossil.

Specimen Examined. Brazil: Itapicurú River near Bahia, State of Bahia, holotype (M.C.Z. No. 151511. — From the Peabody Museum in Salem; collector unknown).

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
43 mm.	20	17.5	23	8	5	Holotype

Strophocheilus (Strophocheilus) calus Pilsbry

Pl. 17, fig. 5; Pl. 19, fig. 3; Pl. 32, fig. 5

Helix (Cochlogena) pudica var. *rhodostoma* Moricand, 1836, Mém. Soc. Phys. Hist. Nat. Genève, **7**, pt. 2, p. 438 (Brazil: Bahia). Not *Helix rhodostoma* Draparnaud, 1801.

Strophocheilus (*Strophocheilus*) *calus* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 119; Pl. 18, figs. 46–47 (Brazil);[1] 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Bulimus pudicus Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 31, fig. 191. Not of O. F. Müller, 1774.

The cotypes of Moricand's *H. pudica* var. *rhodostoma* are now at the Geneva Museum. Through the courtesy of Dr. G. Mermod the M.C.Z. was recently presented with five of them (M.C.Z. No. 175520). One of these, of 5⅓ whorls, is 60 mm. long, 30 mm. wide in front view, 23.5 mm. wide in profile, with the aperture 36 by 13 mm. The name *rhodostoma* was published with a brief description: "bouche d'un beau rose pourpre." According to Dr. Mermod (*in litt.*, 1947), Blanchet collected in the region of Bahia 300 specimens which Moricand referred all to *S. pudicus*, but divided into a white-lipped (var. *leucostoma*) and a pink-lipped (var. *rhodostoma*) variety. However, as Dr. Mermod recognized, these two varieties are not cospecific. While the white-lipped specimens are not separable from typical *pudicus*, those with pink lips show all the characters of Pilsbry's *S. calus*. The holotype of *S. calus*, at the A.M.N.H., New York (No. J4668), is shown in Pl. 19, fig. 3.

Specimens Examined. BRAZIL: Several without more definite locality at A.M.N.H. (holotype and 4 others), U.S.N.M., and M.C.Z. (from the old Anthony Collection; the type may have been originally part of this lot). Petrópolis, Est. Rio de Janeiro (M.C.Z. — Collector unknown). Caçatu, Municipio de Antonina, Est. Parana (M. J. de Oliveira. — M.C.Z.).

S. calus is characterized by the shape of the columella, with its strong, but narrow, usually white fold, set off from the umbilical edge and from the base of the parietal wall by a broad, lengthened depression, which is seen distinctly in Reeve's (1848) figure. The suture of the body-whorl seen from the back is much more oblique than in *S. pudicus*. On the other hand, the width and depth of the umbilical rimation are too variable in both species to be reliable diagnostic features. The relationship to *S. contortuplicatus* is discussed under that species. As a rule the suture is not margined in *S. calus*.

Pilsbry's type of *calus* measured (in mm.): length, 63; diameter, 30; longest axis of aperture with peristome, 36; on the figure the aperture is 11.5 mm. wide within the rim. These measurements have been checked on the type, which has nearly the upper half of the outer lip rose, the lower half with the basal lip yellowish, and the parietal and columellar margins rose with the fold white. Some of the other shells seen agree with this, but others have the entire outer lip roseate.

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[1] In the Explanation of Plates, p. 292, the locality is given as Bolivia. Originally the type specimen was without locality, but "Bolivia" was written in later on the label.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
64 mm.	29	25	38	12	5¼	Caçatu
63	30	24.5	37	12	5⅓	Brazil
61.5	28	23	35	12.5	5⅓	Petrópolis
59.5	29	23.5	36.5	13	5⅓	"
56	27	22	34.5	11	5¼	"

Strophocheilus (Strophocheilus) contortuplicatus (Reeve)

Pl. 8, fig. 1

Bulimus contortuplicatus Reeve, 1850, Conch. Icon., **5**, *Bulimus*, Pl. 88, fig. 658 (Brazil: Minas Geraes). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 314. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 28. Pfeiffer, 1859, Malak. Blätt., 6, p. 37; 1859, Monogr. Helic. Viv., **4**, p. 377; 1868, *Op. cit.*, **6**, p. 22; 1876, *Op. cit.*, **8**, p. 33. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 210.

Bulimus (Strophocheilus) contortuplicatus H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 147. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 150; 1879, Nomencl. Helic. Viv., p. 223.

Bulimus (Strophochilus) contortuplicatus v. Martens, 1860, in Albers, Die Heliceen, 2d. Ed., p. 191.

Plekocheilus contortuplicatus Pilsbry, 1895, Man. of Conch., (2), **10**, p. 71; Pl. 19, fig. 39 (after Reeve).

Strophocheilus (?Strophocheilus) contortuplicatus Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. iv.

At the British Museum *B. contortuplicatus* is now represented by two specimens, one from the Cuming Collection, the other from the Miers Collection (M. Connolly, *in litt.*, 1946). The true type, figured by Reeve, is the one from the Miers Collection.

I have not recognized this species in my material. Major Connolly writes me that the two shells have the extreme apex apparently smooth, but rib sculpture begins to appear on the second whorl. It is therefore certain that the species belongs in *Strophocheilus*, proper. Pilsbry compared his *S. calus* with it and the relationship between the two is extremely close. I was at first inclined to regard *calus* and *contortuplicatus* as cospecific, supposing that Reeve's specimen might have been a freak or abnormal shell. Certain features, however, make this view rather questionable. None of several specimens of *calus* seen show any trace of a subtle granulation or of the impressed subsutural marginal line on the body-whorl seemingly characteristic of *contortuplicatus*. The different shape of the two shells is perhaps not so important. As for the stronger fold of the columella, it may be due to the position in which the shell was drawn, as it is apparently not shown in exact front view. Moreover, the figure shows what appears to correspond to the depression of the columellar area present also in *calus*.

It should be noted that *contortuplicatus* has no true "microspiral striation," Reeve's figure showing only faint, narrow spiral stripes of shading not unlike those of *S. milleri*. Reeve described the surface merely as "very minutely indented," that is to say malleated. Pfeiffer (1853), who evidently saw and redescribed the shell in the Cuming Collection, says that it is "minute malleata et sub lente subtilissime granulata." Pilsbry did not copy Reeve's original description, but only Pfeiffer's later (1853), more complete account.

Reeve's figure is 64 mm. long, 28 mm. in greatest width, with the aperture 34 by 12 mm. Pfeiffer's measurements of another specimen were (in mm.): length, 67; diameter, 27; aperture 36 long with peristome, 15 wide in the middle inside.

STROPHOCHEILUS (STROPHOCHEILUS) MIERSI Da Costa

Pl. 26; fig. 1; Pl. 27, fig. 1; Pl. 31, fig. 3

Strophocheilus miersi Da Costa, 1904, Proc. Mal. Soc. London, **6**, pt. 1, p. 5; Pl. 1, fig. 2 (Brazil: Est. Minas Geraes).

The type of *S. miersi* is now at the British Museum (M. Connolly, *in litt.*, 1946).

Specimen Examined. **BRAZIL**: Est. Espírito Santo (E. Garbe.—D.Z.S.P.; communicated by Dr. Oliverio M. de Oliveira Pinto).

This specimen agrees in every detail with the original description and figure. Moreover, Mr. Lange de Morretes identified it as *miersi* in 1937. The type of the species was collected presumably in the section of Minas Geraes bordering on Espírito Santo.

The shell is very regularly spindle-shaped in outline, with the body-whorl rather obese and slightly saccate at the left base. It is light and rather thin, though solid. The sculpture is similar to that of *S. calus*.

A little more than the first whorl smooth; remaining nepionic whorls covered with close-set, narrow, regular, slightly curved or straight riblets, about as wide as their intervals, extending from suture to suture. Riblets of post-nepionic whorls at first irregular and well-marked only over part of the whorls, particularly below the suture, later gradually weakening and cut up by numerous small malleations; body-whorl thus acquiring an irregular, finely reticulate surface, similar to that of *S. calus*. In addition the body-whorl shows very faint, extremely irregular, short and interrupted, impressed lines, producing in some places weak rugosities, detected only with a strong handlens. This microsculpture is too weak and too irregular to be called a granulation; yet may be similar to what Pfeiffer called "a very subtle granulation" in *contortuplicatus*. Body-whorl with a distinct impressed line a little below the suture, setting off a narrow, coarsely plicate subsutural margin, as in *contortuplicatus*. Aperture regularly semi-elliptical; outer lip moderately reflexed, not flaring, not more expanded toward the base; columella with a narrow, swollen fold, well set off from the parietal wall, but without depressed area; parietal margin slightly longer than columella. In the specimen seen the early whorls only are faintly pinkish, the body-whorl being nearly white and covered with a thin, olivaceous-yellow periostracum; outer lip and columella white; a thin white glaze over the parietal wall. Umbilicus completely closed by the narrow outer margin of the columella.

S. miersi differs from *calus* in the shape of the columella (which lacks the median depression), the presence of a subsutural margin, the regular spindle-shaped outline, the more swollen, somewhat saccate left base of the body-whorl, and the completely closed umbilicus. Most of these characters seem to differentiate it also from *contortuplicatus*.

Da Costa gave the following measurements for his type (in mm.): length, 72; diameter, 35; aperture inside 35 long and 15 wide.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
71 mm.	35	28	40.5	16	5¼	Espírito Santo

As the species is not included in Pilsbry's Manual, a copy of the original description is appended:

"Testa oblongo-ovata, vix perforata, solida, subventricosa, rosacea, epidermide tenui luteo-olivacea induta, spira conica; anfractus quinque, vix convexiusculi, minutissime indentati, ad suturam impressi, submarginati, ultimus descendens, basi rotundatus; columella alba, uniplicata, recedens; apertura oblongo-auriformis, intus albida; peristoma album, incrassatum, expansum, et reflexum, marginibus callo albido junctis."

STROPHOCHEILUS (STROPHOCHEILUS) PLANIDENS (Michelin)

a. Typical PLANIDENS

Pl. 1, fig. 3; Pl. 12, fig. 1; Pl. 18, fig. 2; Pl. 25, fig. 1; Pl. 32, fig. 4

Bulimus planidens Michelin, 1831 (before September), Guérin's Mag. Zool., **1**, Mollusques, Pl. 25 (2 figs. of same shell; with description in letterpress; "Brazil").[1] Deshayes, 1838, in Lamarck, Hist. Nat. An. Sans Vert., 2d Ed., **8**, p. 239; 1844, *Op. cit.*, 3d Ed., **3**, p. 354. Jay, 1839, Cat. Shells Coll., 3d Ed., p. 56; 1850, *Op. cit.*, 4th Ed., p. 205. Küster, 1841, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 17; Pl. 3, fig. 1. Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 120. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 159. Porro, 1846, Coll. Mus. Mediol., Moll. Terr. Fluv., p. 14. Pfeiffer, 1848, Monogr. Helic. Viv., 2, p. 54 (Brazil: Nova Friburgo, Est. Rio de Janeiro). Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 31, fig. 190. Deshayes 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 38; Atlas, Pl. 143, figs. 4–5 (Expl. of Plates, p. 20). Pfeiffer, 1853, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. viii; 1853, Monogr. Helic. Viv., **3**, p. 316. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 29. Pfeiffer, 1859, Monogr. Helic. Viv., 4, p. 378. A. D. Brown, 1866, Cat. Shells Coll., 2d Ed., p. 59. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 23. Haines, 1868, Cat. Terr. Shells Coll., p. 54. Paetel, 1896, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 46 (Brazil: Corcovado near Rio de Janeiro). Paetel, 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 34. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), p. 93.

Helix (Cochlogena) planidens Rang, 1831 (September), Ann. Sci. Nat., **24**, p. 54 (Brazil: Province of Cantagallo, State of Rio de Janeiro, the type locality).

Bulimus (Bulimus) planidens Anton, 1839, Verzeichniss Conchyl.-Samml., p. 40.

Bulimus (Coniclus) planidens Albers, 1850, Die Heliceen, p. 147.

Bulimus (Strophocheilus) planidens H. and A. Adams, 1855, Gen. Rec. Moll.,

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[1] The letterpress is dated "October, 1830," but 1831 is accepted by Pilsbry and Sherborn as the true date of publication. Although the title page of the first volume of the "Magasin de Zoologie" bears only the date 1831, it is certain that parts of it appeared in 1830. The mollusk portion was at first issued as a special periodical called "Magasin de Conchyliologie," of which 2 parts ("livraisons"), of 8 plates each, appeared in 1830 (see Froriep's Notizen Natur- u. Heilk., **29**, p. 175; No. 627 for January 1831). I have found no evidence on which to settle the date of publication of Plate 25. Rang (1831) quotes Michelin's description and figures, which were based on material collected by himself.

2, p. 147. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 151; 1879, Nomencl. Helic. Viv., p. 223. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 122.

Bulimus (*Strophochilus*) *planidens* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191. P. Fischer, 1883, Manuel Conchyliologie, p. 472.

Strophocheilus (*Strophocheilus*) *planidens* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 7; Pl. 22, fig. 50 (after Reeve); 1896, *Op. cit.*, (2), **10**, p. 194; 1902, *Op. cit.*, (2), **14**, Classification, p. iv. Haas, 1935, Arch. f. Molluskenk., **67**, p. 111 (Brazil: Therezópolis, Est. Santa Catharina).

Michelin described *planidens* from at least two specimens collected by Rang. One of these cotypes (Pl. 32, fig. 4) is now at the Paris Museum (E. Fischer, *in litt.*, 1946), though apparently not the one originally figured.

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; M.U.Mich.; N.H.M.Chic.; Ac.N.S.Phila.; U.S.N.M.; A.M.N.H.). Nova Friburgo, Est. Rio de Janeiro (U.S.N.M.). Cantagallo, Est. Rio de Janeiro, topotype (M.C.Z.; received from the late P. Dautzenberg). Itatiaya Mts., Est. Rio de Janeiro (Rose and Russell. — U.S.N.M.). Serra de Macahé, Est. Rio de Janeiro (M.C.Z.). Piquete, Est. São Paulo (H. v. Ihering. — U.S.N.M.).

Shell regularly spindle-shaped in front view, distinctly flattened in profile. Periostracum with an exceedingly fine, non-granulose, wavy, spiral striation, weakly decussating the vertical growth-lines; as a rule no malleation, though sometimes traces of it on back of body-whorl. Parietal wall almost always much shorter than columella. Tooth of outer lip extremely variable in size and shape, usually wider at base than high, occasionally very weak or absent; these differences probably due to age, the tooth only developing fully in older specimens. After the tooth appears the inner edge of the lip may thicken or flatten out into a blunt ridge, particularly at base of aperture. The columella also flattens with age, producing sometimes a low, elongate hump about mid-height on the inner edge. Umbilicus varying from almost closed or narrowly rimate to perforate or moderately open. Outer lip and columella rose-red, brownish-red or brown. Aperture regularly semi-elliptical in contour, relatively longer and narrower than in *unidentatus*.

Michelin's figure is 67 mm. long, 32 mm. wide in front view, the aperture 37 by 15 mm. Reeve's figure is 68.5 mm. long, 33.5 mm. wide in front view, the aperture 38 by 13.5 mm. Pilsbry gives measurements of two shells, respectively 66 and 60 mm. long, 33 and 29 mm. wide, the aperture 37 and 32 mm. long.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
70 mm.	32.5	28.5	40	15	5⅛	Brazil
68	33.5	29.5	38.5	15	5⅛	Brazil
66	30.5	24.5	36	14	5⅛	Cantagallo
65	31.5	27.5	36.5	15	5⅛	Brazil
64	30.5	27	35	13	5⅛	Brazil
59.5	29	24.5	34.5	13	5¼	Piquete
58	28	23	32	12	5¼	Itatiaya
57	25.5	23	30	13	5¼	Brazil

Copy of Michelin's original description of *S. planidens* (French text translated): "B. testa ovata, elongata, tenui, diaphana, longitudinaliter et exilissime striata, virido-nigricante; ultimo anfractu, magno, oblique posito; columella rosea; labro crasso, margine roseo, reflexo cum dente plana; interius griseo-argenteus. Long. 65 mill.; larg. 30 mill. A very rare shell in collections, unusual looking owing to the last whorl being oblique to the axis and owing to the parallelism of the other whorls. As a result the aperture is scarcely over half the total length. But the prominent feature, distinguishing it from congeneric species, is a flat tooth placed inside midway of the right margin, reaching 4 to 5 mm. in length and 2 mm. in height above the margin. The color of the shell is olivaceous-green externally and silvery-gray internally. The columella and the margins are pinkish-purple."

b. S. PLANIDENS JAUSSAUDI (Lange de Morretes)

Pl. 21, fig. 3

Coniclus jaussaudi Lange de Morretes, 1937, Rev. Mus. Paulista, **23**, p. 303; Pl. 2, figs. 1–4 and center figure (Brazil: Morungaba, Senges, Est. Paranà).

C. jaussaudi was described from three specimens. The holotype is said to be in the author's collection and I have not seen this; but one of the two paratypes was deposited at the D.Z.S.P. (formerly Museu Paulista) and I was able to study it through the courtesy of Dr. Oliverio M. de Oliveira Pinto.

Specimen Examined. BRAZIL: Morungaba, Senges, Est. Paraná, paratype (J. Santos. — D.Z.S.P. No. 14131).

Except for the much smaller size, this paratype agrees in almost every respect with some specimens of *S. planidens*, so much so that I consider *jaussaudi* as a dwarf race of that species. The following differences may also be noted, although they seem to be of little significance. Aperture smaller, its greatest axis only half the total length of the shell; while in all typical *planidens* seen it is decidedly or much longer than half the total length. Inner rim of outer lip even, without a trace of the flattening or crest usually developed in the typical form, particularly at the base near the columella. Body-whorl without a trace of the subsutural margin generally present in the typical form. Parietal edge of outer lip scarcely ascendent, whereas it is decidedly so in typical *planidens*. The other characters are as in the typical form: shell spindle-shaped, the proportions being much the same; terminal subsutural area of body-whorl strongly depressed behind parietal edge of outer lip; tooth of outer lip low, elongate, in the same position; umbilicus very narrowly slit-like. The paratype seen is badly weathered and corroded and appears to have been subfossil. However, the vertical riblets of the nepionic whorls are more or less preserved; and on the body-whorl there are here and there faint traces of the wavy, spiral microsculpture characteristic of the *planidens* group.

Lange de Morretes gave the following measurements for the holotype (in mm.): length, 45.5; width, the lip included, 25; width, exclusive of lip, 23; height [width in profile], 20; height of aperture, 24; width of aperture, 15; major axis of aperture, 24.5; width of reflexed lip on the right side in front, 2; weight, 3 grams. Two paratypes measured 46 mm. in length and weighed 3½ grams.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
46 mm.	25	20	24	10	4⅓	Morungaba, paratype

Original description (translated from the Portuguese): "Shell thin, of 4⅔ whorls; aperture small and elongate, with the inner and outer margins parallel; a tooth longer than high, well marked on the inside midway on the outer lip; lip thin, reflexed and strongly recurved so as to form a deep groove between its end and the wall of the last whorl; aperture arcuate upward beginning at the end of the tooth. Approaching *Coniclus unidentatus* in size, but less bulky and more of the shape of a small *S. erythrosoma* Pilsbry. Its tooth is quite different from that of *unidentatus* and similar to that of *Coniclus planidens* (Michelin)."

c. S. planidens fusoides, new subspecies

Pl. 9, fig. 2; Pl. 12, fig. 2; Pl. 25, fig. 2

Shell of the fusiform shape and with the shortened parietal wall, microsculpture and nearly even or weakly malleated surface of typical *planidens*; but smaller and with relatively shorter spire, resembling in these respects subsp. *jaussaudi*. Outer lip thin, somewhat expanded, even and not flattened nor crested inside, without median tooth-like swelling. Umbilicus broadly open, deeply perforate. Traces of periostracum preserved here and there on the body-whorl, which, moreover, shows distinctly the microsculpture of wavy, spiral striolae. Outer lip and columella slightly roseate.

Specimens Examined. Brazil: Taquara do Mundo Novo, Est. Rio Grande do Sul, holotype (H. v. Ihering. — M.C.Z. No. 75314; originally part of the Putzeys Collection), and paratype (H. v. Ihering. — U.S.N.M. No. 122306).

An immature shell, from Rio Grande, Est. São Paulo (H. v. Ihering. — U.S.N.M. No. 162493), is possibly of subsp. *fusoides*.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
56 mm.	27.5	23	30	13	5	Taquara, paratype
52	26.5	22.5	28	12.5	5	Taquara, holotype

Strophocheilus (Strophocheilus) unidentatus (Sowerby)

Pl. 6, fig. 3; Pl. 9, fig. 6

Partula unidentata Sowerby, 1825, Cat. Shells Earl Tankerville, p. 40 (name only) and Appendix, p. vii (no locality; with description). J. E. Gray, 1825, Ann. of Philos., (N.S.), **9**, p. 415.

Bulimus (*Bulimus*?) *unidentatus* Beck, 1837, Index Moll., pt. 1, p. 53.

Bulimus unidentatus Pfeiffer, 1846, Symb. Hist. Helic., **3**, p. 88 (Brazil); 1848, Monogr. Helic. Viv., **2**, p. 54; 1853, *Op. cit.*, **3**, p. 316; 1859, *Op. cit.*, **4**, p. 378; 1868, *Op. cit.*, **6**, p. 23; 1876, *Op. cit.*, **8**, p. 34. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 31, fig. 192 (Brazil). Philippi, 1850, Abb. Beschr. Conch., **3**, p. 99; Pl. 9 (*Bulimus*), fig. 8. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 39; Atlas, Pl. 143, fig. 6 (Expl. of Plates, p. 20). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 29. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99; 1889, *Op. cit.*, 4th Ed., **2**, p. 218.

Partula unidentata Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 163.

Bulimus (*Coniclus*) *unidentatus* Albers, 1850, Die Heliceen, p. 147.

Bulimus (*Strophocheilus*) *unidentatus* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 147. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 151; 1879, Nomencl. Helic. Viv., p. 223.

Bulimus (*Strophochilus*) *unidentatus* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191. O. Boettger, 1889, Nachrichtsbl. D. Mal. Ges., **21**, p. 30 (Brazil: Therezópolis, Est. Santa Catharina).

Strophocheilus (*Strophocheilus*) *unidentatus* Pilsbry, 1895, Man of Conch., (2), **10**, p. 9; Pl. 22, fig. 56 (after Reeve); 1896, *Op. cit.*, (2), **10**, p. 194; 1902, *Op. cit.*, (2), **14**, Classification, p. iv. Martins, 1945, Rev. Mus. Nac., Rio de Janeiro, **2**, p. 17, fig.

The present location of the type is not known. It has not been found at the British Museum (M. Connolly, *in litt.*, 1946).

Therezópolis was the only well-defined locality known thus far. There is no reason to doubt the correctness of Boettger's identification, as I have seen *unidentatus* also from the State of Santa Catharina. A shell at Ac.N.S.Phila. is labelled "La Plata Valley," a rather indefinite locality.

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; A.M.N.H.; M.U.Mich.; Ac.N.S.Phila.). Est. Santa Catharina, two specimens (H. v. Ihering. — U.S.N.M.; Ac.N.S.Phila.).

S. unidentatus is much rarer in collections than *S. planidens.* Most specimens I have seen agree in outline and in the shape of the tooth of the outer lip with the few published figures of the species; but in a few the tooth scarcely differs from that of *planidens.* When the periostracum is fairly well preserved, the microsculpture of wavy spiral lines is as in *planidens.* In addition to the differences noted in my synopsis of species, in *unidentatus* the shell is relatively shorter, with more obese body-whorl and slightly deeper sutures, and with relatively shorter aperture mainly due to the shortened columella. The sculpture of the early whorls is somewhat coarser, with the riblets more irregular and frequently anastomosing. As a rule the parietal wall, outer lip and columella are light brown, as figured by Férussac and Philippi; in only one out of some 30 shells are they white (perhaps faded); they are, however, much darker and more like in Reeve's figure in the two specimens from Santa Catharina, which are evidently very fresh.

Reeve's figure of *B. unidentatus* (possibly of the type) is 50 mm. long, 33 mm. wide, the aperture 32 by 13.5 mm. Pilsbry gave for his specimen: length, 53 mm.; diameter, 32 mm.; aperture, 29 by 20.5 mm. (width of aperture including the columella and rim).

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
67 mm.	35	29	37.5	12.5	5¼	Brazil
64	34.5	29.5	36.5	14	5¼	"
63	34	28	34.5	13	5¼	"
61.5	30.5	28	34.5	13	5¼	"
59	29	24	33	11	5¼	Sa. Catharina
57	31	25.5	31	12	5¼	Brazil
55.5	30	26.5	33	12	5¾	"

Original description of *P. unidentata*: "P. testa oblongo-ovata, anfractibus 4 ad 5, rotundatis; apertura castanea, labio externo interne unidentato, dente valido, obtuso. — Obs. About two inches long and one broad, of a pale rose colour; edge of the aperture chestnut."

STROPHOCHEILUS (STROPHOCHEILUS) ERYTHROSOMA Pilsbry

Pl. 9, fig. 5; Pl. 16, fig. 6

Strophocheilus (*Strophocheilus*) *erythrosoma* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 10; Pl. 22, figs. 51–52 (Brazil); 1901, *Op. cit.*, (2), **14**, p. 117; Pl. 17, figs. 42–43 (specimen from Brazil: Iguapé, Est. São Paulo) and 44–45 (after Pfeiffer, 1857); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Strophocheilus (*Strophocheilus*) *porphyrostoma* Clench and Archer, 1930, The Nautilus, **43**, p. 75, figs. 1–3 (Brazil: Mountain near Taquaral, Est. São Paulo).

Bulimus pudicus Pfeiffer, 1857, Malak. Blätt., **4**, p. 180; Pl. 4, figs. 1–2; 1859, Monogr. Helic. Viv., **4**, p. 378 (in part: the description, not the references). v. Martens, 1868, Malak. Blätt., **15**, p. 178 (Brazil: Rödersberg, Est. Rio Grande do Sul). Not of O. F. Müller, 1774.

Strophocheilus (*Strophocheilus*) *pudicus* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 194 (Brazil: Rödersberg).

I have seen the type lot of *erythrosoma* at Ac.N.S.Phila. (No. 30341), consisting of two specimens, the larger one being the figured holotype. The type of *porphyrostoma* is at M.C.Z. (No. 79108; the locality was originally misspelled "Jacquaral"). In 1901, Pilsbry also referred correctly to *erythrosoma* the supposed *B. pudicus* from Brazil figured by Pfeiffer in 1857 and reported from Rödersberg by v. Martens in 1868.

Specimens Examined. BRAZIL: Mountain near Taquaral, Est. São Paulo (holotype of *porphyrostoma*. — M.C.Z.). Paranaguá, Est. Paraná, 10 full-grown specimens (Graham B. Fairchild. — M.C.Z.). Caçatu, Municipio de Antonina, Est. Paraná, 3 specimens (M. J. de

Oliveira. — M.C.Z.). Poço Grande, Vale do Rio da Ribeira, Est. São Paulo, 2 specimens (M.C.Z.). Blumenau, Est. Rio Grande do Sul, 1 specimen (M.U.Mich.). Taquara do Mundo Novo, Est. Rio Grande do Sul, 2 specimens (H. v. Ihering. — U.S.N.M.). Iguapé, Est. São Paulo, 2 specimens (H. v. Ihering. — Ac.N.S.Phila.). Rio Grande, Est. São Paulo, 1 specimen (M.C.Z.).

The most reliable specific characters of *S. erythrosoma* are the strong malleation of the body-whorl; the minute spiral striation, which is very close and wavy, as in *planidens*, but somewhat coarser, engraving the shell itself, though wearing away rapidly after the periostracum is lost; and the untoothed outer lip, the rim of which is either even or slightly thickened about mid-length on the inner margin (the thickening was somewhat exaggerated in the published drawing of the holotype; it is even less pronounced in the paratype and not apparent in the other specimens seen). In addition, the body-whorl is strongly swollen, particularly at the base of the left side which is slightly saccate, and its suture is much more slanting than the one above it. The columellar rimation is very narrow or obliterated. The peristome varies from roseate to nearly white and is chocolate-brown in the Blumenau shell. Both Iguapé specimens appear to be very fresh, yet one has a white and the other a light brown, somewhat roseate peristome. In both *erythrosoma* and *planidens*, the columella is much narrower and straighter than in *pudicus*, and without the trace of a fold.

Pilsbry gave the measurements of the figured type (in mm.) as: length, 53; width, 28; aperture, 28 by 18 (width measured outside the columella and outer lip); but the shell is actually slightly larger, as shown by the measurements given below. In 1901, Pilsbry figured the larger of the two Iguapé specimens, which is also included in the subjoined table. The species varies greatly in size and very small specimens might be mistaken for a distinct race, were they not connected by medium-sized shells with the larger ones. All sizes, moreover, are found together; for instance, the largest and smallest shells seen were collected at Caçatu.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
64.5mm.	33.5	27	35	12.5	5	Caçatu
60	31	26	32	12.5	4⅔	Iguapé
59.5	30	24	34	11.5	4⅔	*porphyrostoma*, holotype

58.5	32.5	24.5	34	12	4⅔	Paranaguá
57	30	24	34.5	12	4⅔	“
56	28.5	24	31	12	4¼	*erythrosoma*, holotype
53.5	29	23.5	31	10.5	4½	Poço Grande
51	26	23	29.5	11	4¼	Iguapé
49	26.5	22	27.5	10.5	4½	Caçatu
49	27.5	23	29	11.5	4¼	*erythrosoma*, paratype
44	25.5	21	24.5	10	4¼	Paranaguá
42.5	25	19	24.5	9.5	4¼	Caçatu
40.5	23.5	18.5	23	9	4¼	“

STROPHOCHEILUS (STROPHOCHEILUS) ATAVUS, new species

Pl. 8, fig. 3

Shell medium-sized, ovate in outline seen in front, widest about mid-length, the spire more tapering than the base. Whorls 5, separated by shallow sutures, that of the body-whorl seen from the back more oblique than the one above it. Spire very short, obtusely pointed, as now preserved (the early whorls being preserved only as inner casts, the spire was probably longer). Body-whorl moderately convex, shaped much as in *S. erythrosoma*, somewhat saccate at the base to the left of the columella, moderately flattened dorso-ventrally, its upper terminal portion slightly depressed behind the outer lip. Aperture (as preserved) semi-elliptical; parietal wall heavily calloused, about as long as columella; outer lip expanded (rim mostly lacking); columella nearly straight, much widened and flat near the parietal wall, the outer edge overlapping the well-pronounced umbilicus, which was probably openly rimate, the base evenly rounded into the outer lip. Nepionic sculpture unknown (shell material lacking from early whorls). Penultimate and body-whorl with the shell material mostly preserved, showing moderately spaced, regular growth-striae and here and there what may be traces of spiral raised lines divided into granules. The shell is completely filled with a hard, compact, white, calcareous matrix.

Specimen Examined. URUGUAY: Migues, Canelones, holotype (F. Felippone. — U.S.N.M. No. 383007); fossil in unidentified strata (“terrenos calizo”), which I presume to be Tertiary.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
43 mm.	28	23	24.5	12.5	5	Holotype

Although the nepionic sculpture is unknown, the general shape of the shell and of the aperture make its place in the subgenus *Strophocheilus*, proper, fairly certain. This extinct species is not referable to any Recent form, but is perhaps closest to *S. erythrosoma*. It is very distinct from both the fossil species, *S. chubutensis* and *S. hauthali.*

STROPHOCHEILUS (?STROPHOCHEILUS) CHUBUTENSIS H. von Ihering

Strophocheilus (*Strophocheilus*) *chubutensis* H. v. Ihering, 1904, Rev. Mus. La Plata, **11**, p. 241; Pl. 2, figs. 13–14 (Argentina: Cañadón Blanco between the Senguerr and Chubut Rivers, and Río Chico, Chubut; fossil in Lower Tertiary deposits); 1907, An. Mus. Nac. Buenos Aires, (3), **7**, pp. 460 and 463; 1914, Notas Preliminares Rev. Mus. Paulista, **1**, No. 3, p. 70.

Megalobulimus chubutiensis Parodiz, 1946, Notas Mus. La Plata, 11, Paleont. No. 92, p. 308 (types; states that the specimens from Cañadón Blanco and from Río Chico might represent different forms or subspecies).

Original description of *S. chubutensis* (Spanish text translated): "*Strophocheilus* testa oblongo-ovata imperforata, spira brevi, acuminata, anfractibus 5 tumidis, primis longitudinaliter costatis; apertura parviuscula, labro reflexo. Length, 58 mm.; greater diameter, 27 mm.; aperture, 25 mm. long and 15 mm. wide. The shell is oblong-ovate in shape and consists of 5 to 6 nearly flat whorls, separated by a slightly deep suture. The outer lip is thick and reflexed; the inner lip is adherent to the adjacent portion of the shell. The aperture, relatively small, does not reach half the total length of the shell. One of the shells shows vestiges of the sculpture, which, on the third whorl, consists of sharp riblets spaced about one mm. apart and crossed by spiral lines. The species is related to *S. almeida* [= *S. pudicus*] and similar species of the subgenus *Strophocheilus* Spix, from which it differs only in the more pronounced longitudinal riblets."

The figures resemble best *S. erythrosoma* Pilsbry in shape, having the same wide body-whorl, with saccate left base; but the shell is smaller and much narrower. The aperture is very poorly preserved. In his later paper (1907) v. Ihering places the deposits of Cañadón Blanco in the Cretaceous, evidently following Ameghino, who calls the strata containing *chubutensis* his "étage notostylopéen."

Subgenus SPEIRONEPION J. Bequaert

This group was defined above in the synopsis of subgenera. It contains two species, restricted to southeastern Brazil (Rio de Janeiro, Minas Geraes, São Paulo, and Espírito Santo).

STROPHOCHEILUS (SPEIRONEPION) MILLERI (Sowerby)

The most characteristic feature of *S. milleri* is the fine, closeset spiral sculpture of the nepionic whorls. The spiral striae continue over the later whorls, but are superficially divided into minute beads or granules. Outer lip not toothed; columella straight, oblique and flattened, without fold; umbilical rimation narrow, slit-like, or completely closed. Shells with these characters vary in outline, as well as in shape and size of aperture. I have provisionally retained the two described variants as subspecies, as it is not clear, from the limited and poorly localized material seen, that they intergrade with the typical form or occur with it.

a. Typical MILLERI

Pl. 22, fig. 4; Pl. 31, fig. 5

Bulinus milleri Sowerby, 1838 (before October 31), Conchol. Illustr., *Bulinus*, fig. 94 of pt. 144 (name in accompanying printed list; no locality).

Bulimus milleri Reeve, 1842, Conch. Syst., **2**, p. 82; Pl. 174, fig. 94 (after Sowerby, 1838). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 157. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 28, figs. 169*a-b* (Brazil). Pfeiffer, 1842, Symb. Hist. Helic., **2**, pp. 48 and 118; 1848, Monogr. Helic. Viv., **2**, p. 44 (Brazil, received from Bescke). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 201. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 305. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 29. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 368. A. D. Brown, 1861, Cat. Shells Coll., p. 46; 1866, *Op. cit.*, 2d Ed., p. 57. Haines, 1868, Cat. Terr. Shells Coll., p. 51. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 12. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98 (Brazil: Rio de Janeiro). Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 16. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 214. Hidalgo, 1900, Mem. Acad. Cienc. Madrid, **19**, (1893–1900), p. 124.

["Bulime de Miller" Chenu and Desmarest, 1858, Encycl. Hist. Nat., Crust. Moll. Zooph., p. 157, fig. 156].

Bulimus (Coniclus) milleri Albers, 1850, Die Heliceen, p. 147 (Brazil: Est. Rio de Janeiro).

Bulimus (Strophocheilus) milleri H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 147. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 150; 1879, Nomencl. Helic. Viv., p. 223. Chenu, 1859, Man. Conchyl., **1**, p. 435, fig. 3199. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 122. Tryon, 1884, Struct. Syst. Conch., **3**, p. 49; Pl. 97, fig. 15 (after Chenu).

Bulimus (Strophochilus) milleri v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191.

Strophocheilus (Strophocheilus) milleri Pilsbry, 1895, Man. of Conch., (2),

10, p. 8; Pl. 22, figs. 54–55 (after Reeve, 1848); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

The present location of Sowerby's type, figured in 1838 and 1842, is not known. It is not to be found at the British Museum (M. Connolly, *in litt.*, 1946).

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; M.U.Mich.; Ac.N.S.Phila.; U.S.N.M.; A.M.N.H.; M.N.H.-Chic.). Rio de Janeiro (U.S.N.M.). One specimen at M.C.Z., received by Anthony from Cuming, is labelled "Bahia," probably by error.

Sowerby's original figure shows a moderately broad shell, with relatively weak sutures and long aperture. Reeve (1848) figured a larger and slightly narrower shell, not differing otherwise. Chenu's drawing (1858 and 1859) is clearly reduced, as are most of the shells figured on the same page, and may have been copied from Reeve. The spiral banding, shown by Sowerby and Reeve, is not of color, "but of light and shade, as in shot-silk" (Reeve). It is more or less developed, often scarcely to be detected, and was possibly exaggerated in the early figures. Some shells are very pale, almost yellowish below the sutures; others are uniformly chestnut-brown to yellowish-brown with darker oblique streaks, but without spiral markings.

Sowerby's figure of the type of *milleri* measures (in mm.): length, 60; greatest width, 32; the aperture, 33 by 15. Reeve's specimen of 1848 is somewhat larger, the figure being 66 mm. long, 35 mm. wide, with the aperture 34.5 by 16 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
65 mm.	32	27.5	35.5	13.5	5	Brazil
62.5	32.5	27.5	34	14	5	"
61	30.5	26	34	13	5	"
58	31	27	34	14.5	5	Bahia (?)
57	29.5	25.5	31	12.5	5	Brazil

b. S. MILLERI KRONEI H. v. Ihering

Pl. 7, fig. 1; Pl. 20, fig. 3; Pl. 32, fig. 1

Strophocheilus milleri var. *kronei* H. v. Ihering, 1901, in Pilsbry, Man. of Conch., (2), **14**, p. 118; Pl. 19, figs. 58–59 (Brazil: Rio Grande, Est. São Paulo). Pilsbry, 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

The type (No. 1122) is at the Departamento de Zoologia, Secretaria da Agricultura (formerly Museu Paulista), in São Paulo. I have not seen it.

Specimens Examined. BRAZIL: Rio Grande, Est. São Paulo, two topotypes (one M.C.Z. No. 179242, received from Dr. Oliverio M. da Oliveira Pinto with the No. 1122; another Ac.N.S. Phila. No. 109062, received from H. v. Ihering with the No. 1122*a* and a note: "the figured example [of *kronei*] has the columella somewhat sinuous, which is an exception").

The original description of *kronei* seems to have been written by Pilsbry, although he credits the name to H. v. Ihering only, and the figures were drawn from the type, which was returned afterward to São Paulo. As the note following the description states expressly that only the type was seen, other specimens from the same locality and probably collected at the same time (including the two I have studied) can only be topotypes.

The variety was described as "broader, more inflated" than *milleri*. It was noted, furthermore: "The adnate portion of the reflexed columellar lip is thinner than in *milleri*, closely appressed and concave, leaving no umbilical chink whatever, and the columella is somewhat sinuous. The spiral striae are less granulose than in *milleri*." In the two topotypes seen the columella is no more sinuous and the granulation is no weaker than in typical *milleri*. Some specimens of the typical form, moreover, are about as obese as *kronei*. The only difference remaining seems to be the completely closed unbilical slit. In typical *milleri* the width of the umbilical rimation varies, however, and in one (very slender) shell it is almost completely closed. Although retained for the present, *kronei* seems to be scarcely separable from the typical form.

The measurements given for the type of *kronei* were (in mm.): length, 62; diameter, 32.5 [evidently the width of the body-whorl *above* the aperture]; longest axis of aperture, 34.5. The two figures of the type are, however, slightly larger, being respectively 64 and 66 mm. long and 35 mm. in greatest width in front view, the aperture 35 by 15.5 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
71 mm.	35	31	38	15	5	Rio Grande, topotype
65	34	29	35.5	15	5	" "

The topotype received from Dr. de Oliveira Pinto contained an egg of the usual ellipsoid shape, broadly and equally rounded at both ends, 13.5 mm. long and 10.5 mm. wide (Pl. 32, fig. 1).

c. S. MILLERI IGUAPENSIS Pilsbry

Pl. 1, fig. 2; Pl. 26, fig. 5

Strophocheilus milleri var. *iguapensis* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 119; Pl. 18, figs. 48–49 (Brazil: Iguapé, Est. São Paulo); 1902, *Op. cit.* (2), **14**, Classification, p. iv.

I have seen the type of *iguapensis*, now at Ac.N.S.Phila. under No. 30343.

Specimens Examined. BRAZIL: Iguapé, Est. São Paulo, holotype (H. v. Ihering. — Ac.N.S.Phila.) and topotype apparently collected with the holotype, but not mentioned with the original description and evidently received later (H. v. Ihering. — Ac.N.S.Phila. No. 71232). Campos do Jordão, Est. São Paulo (H. Lüderwaldt. — M.C.Z.).

The holotype and topotype are very similar, but the shell from Campos do Jordão is smaller, though of the same general shape. I retain *iguapensis* provisionally as a subspecies differing from typical *milleri* in the shorter, more obese body-whorl, the relatively shorter aperture, and the weaker granulation. Pilsbry states that the fine spiral striae are smooth, not granulose. While this is true of the holotype and topotype, it seems to be due to weathering, the shells being denuded of cuticle. In the shell from Campos do Jordão the periostracum is well preserved over the penultimate and body-whorl, where the spiral lines are slightly to very superficially granulose. Pilsbry also says that the length of the aperture in *iguapensis* equals the diameter of the shell, while in *milleri* and *kronei* it exceeds it slightly. It should be noted that by diameter is meant the width in front view of the body-whorl *above* the aperture. Compared to the greatest width in front view, as given in my measurements, the relative length of the aperture is not so different in the three forms of *milleri*. The umbilical slit of *iguapensis* is moderately open, as in the average typical *milleri*.

The original measurements given for *iguapensis* were (in mm.): length, 59; diameter, 32.5 [evidently width of body-whorl above aperture]; longest axis of aperture, 32.5. Pilsbry's fig. 49 is the correct size, while fig. 48 is a trifle too large.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
59 mm.	35	29.5	32.5	15.5	5	Iguapé, holotype
59	32	26.5	32	14	5	" , topotype
51	29	24.5	27	12.5	5	Campos do Jordão

STROPHOCHEILUS (SPEIRONEPION) PILSBRYI H. v. Ihering

Pl. 4, fig. 3; Pl. 6, fig. 6; Pl. 17, fig. 3; Pl. 29, fig. 1

Strophocheilus pilsbryi H. v. Ihering, 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 394; Pl. 11, fig. 4 (Brazil: Piquete, Serra da Mantiqueira, Est. São Paulo).

Strophocheilus (*Strophocheilus*) *pilsbryi* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 118; Pl. 17, figs. 46–47 (type); 1902, *Op. cit.*, (2), **14**, Classification, p. iv. Haas, 1937, Arch. f. Molluskenk., **69**, p. 244, figs. 1–3 (Brazil: Itajubá, Est. Minas Geraes).

The type lot at Ac.N.S.Phila. (No. 171230) consists of the figured holotype, with complete peristome, and a paratype with partly broken outer lip.

Specimens Examined. BRAZIL: Without more definite locality (U.S.N.M.). State of Rio de Janeiro (F. Schade. — M.C.Z.). State of Espírito Santo (Ad. Lutz. — M.U.Mich.). Piquete, Est. São Paulo, holotype and paratype (H. v. Ihering. — Ac.N.S.Phila.), and one paratype (M.C.Z. No. 179236).

S. pilsbryi is very close to *S. milleri*, of which I was at first inclined to regard it as a race. However, the following differences hold good in six specimens, from four different sources, and I have observed no transitional shells. The shell is much more slender, with narrower body-whorl and more tapering, conical spire, in which the whorls are separated by much deeper sutures. This difference is particularly striking in a back view. The granulose sculpture is markedly coarser, as shown in Haas' excellent figures; on the body-whorl the wavy raised spiral lines are mostly replaced by spirally arranged, disconnected granules. The umbilical slit is narrowly perforate. The aperture is relatively short and wide in the holotype, with a very oblique columella; but in other specimens its shape varies too much to be reliable. The nepionic sculpture is very nearly the same in both species.

Pilsbry gave the measurements of the holotype as: length, 48 mm.; diameter, 24 mm.; aperture, 25 mm. long; in his figure the aperture is 11.5 mm. wide. Haas' specimens, typical in every respect, were 53 mm., 51 mm., and 40 mm. long, with the corresponding width of 29.5 mm., 24.5 mm., and 23 mm.; the aperture, measured from the left edge of the columella to the right edge of the outer lip, was 25 mm., 27 mm., and 22 mm. (measured by the same method, the aperture is 26.5 mm. wide in Pilsbry's holotype).

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
60 mm.	28.5	25	32.7	14.5	5	Rio de Janeiro
57	27	24	29.5	15	5	Brazil
55.5	28	23.5	32	12	5	Espírito Santo
47	24	21	26	12	5	Piquete, paratype
43	23.5	20	23.5	12	5	" "

Subgenus MEGALOBULIMUS Miller

Bulimus Scopoli, 1786, Delic. Flor. Faun. Insubriae, **1**, p. 67. Type by monotypy: *Bulimus haemastomus* Scopoli, 1786 = *Strophocheilus oblongus* var. *haemastomus*. Bruguière, 1789, Encycl. Méthod., Vers, **1**, pt. 1, pp. xvi and 286 (in part). Lamarck, 1799, (An VII), Mém. Soc. Hist. Nat. Paris, p. 75 (see Kennard, Salisbury and Woodward, 1931, Smithson. Miscell. Coll., **82**, No. 17, p. 21). Not *Bulimus* Scopoli, 1777.

Bulimus subgenus *Borus* Albers, 1850, Die Heliceen, p. 141 (for 21 described species; with description). Type by designation of v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191: *Helix oblonga* O. F. Müller, 1774, one of the species originally included. Not *Borus* L. Agassiz, 1846.

Corus Jousseaume, 1877 (October), Bull. Soc. Zool. France, **2**, p. 311 (without description; in the combination "*Corus* (*Bulimus*) *valenciennnensi*"). Type by monotypy: *Bulimus valenciennesii* Pfeiffer, 1842. Obvious misprint for *Borus*.[1] Strand, 1928, Arch. f. Naturgesch., **92**, (1926), Abt. A, pt. 8, p. 66.

Bulimus subg. *Megalobulimus* Miller, 1878, Malak. Blätt., **25**, p. 172 (with description; name proposed tentatively for a group of species of *Borus*, of which only one is mentioned by name). Type by monotypy: *Borus garciamoreni* Miller, 1878 = *Bulimus popelairianus* Nyst, 1845.

Strophocheilus subg. *Megabulimus* Haas, 1935, Arch. f. Molluskenk., **67**, p. 110 (error for *Megalobulimus*, with same type).

Lophocheilus Hermano Daniel, 1942, Rev. Acad. Colombiana Cienc. Exact.

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[1] The question of *Borus* Agassiz, 1846, versus *Borus* Albers, 1850, was submitted to the International Commission on Zoological Nomenclature, who decided that they are homonyms (Opinion 125, 1936, Smithson. Misc. Coll., **73**, No. 8, pp. 3–4). I agree with Pilsbry that *Corus* was a typographical error for *Borus*, hence not entitled to priority over *Megalobulimus*. In his later writings Jousseaume himself used *Borus*.

Fis. Nat., **4**, Nos. 15–16, (1941), p. 376 and Pl. 2, fig. 95A (in the combination *Lophocheilus oblongus* Müller; evident misspelling of *Strophocheilus*).

Streptocheilus de Souza Lopes, 1940, Revista de Entomologia, **11**, p. 940 (in the combination *Streptocheilus capillaceus intertextus* Pilsbry; error for *Strophocheilus*).

Synopsis of Species

By far the greatest number of *Strophocheilus* belong in *Megalobulimus*, 20 species being recognized in this paper. The most reliable specific characters are in the nepionic sculpture of vertical riblets, "nepionic riblets" for short, which may differ in size, spacing, shape, and extent. The differences are, however, difficult to describe concisely, being sometimes relatively slight. They are best appreciated by a comparative study. In this subgenus I have been compelled to draw up new and fairly extensive specific descriptions on a comparative basis, taking into account the range of variation. This was particularly necessary in order to justify my degrading so many of the described forms to either synonyms or subspecies. In general, shells which agree in the nepionic sculpture should be regarded as very closely related and, with a few exceptions, as at most subspecifically distinct. Size and shape are very unreliable, except for separating subspecies.

The synopsis is at best an introductory guide to identification, to be controlled in every case by a study of the more detailed description. In grouping the species I have been guided by convenience only, particularly where the outline of the shell is used. In some cases this will apply to the typical form only of the species and not necessarily to the other subspecies.

S. indigens, *S. hector* and *S. cocapatensis*, being unknown to me, are not included.

A. Riblets regular and continuous from suture to suture over most of the nepionic shell, usually numerous (except in *yporanganus*).

A I. Shell broadly ovate, elongate-ovate or ovate-conical, usually widest below mid-length; spire more tapering than base.

A I*a*. Base of body-whorl not swollen nor saccate to the left of the columella.

1. Nepionic riblets many, narrow, nearly straight, separated by intervals nearly twice the width of a riblet. Shell usually with conical spire and narrow, bluntly pointed summit. Aperture rather narrowly semi-elliptical, with nearly straight columella. Peristome bright pink (except in subsp. *albus*). *S. oblongus*, with subsp. *albus*, subsp. *al-*

bescens, subsp. *haemastomus,* subsp. *perelongatus,* subsp. *musculus,* subsp. *elongatus,* subsp. *lorentzianus,* and subsp. *conicus.*

2. Nepionic riblets finer and more crowded than in *S. oblongus,* the intervals about the width of a riblet. Shell with lower, wider spire and broadly rounded summit. Aperture as in *S. oblongus.* Peristome bright pink. *S. intertextus.*

3. Nepionic riblets similar to those of *S. oblongus,* but slightly wider and more crowded. Shell thin and light; aperture very broadly oval, with strongly curved columella. Peristome white. *S. lichtensteini,* with subsp. *semimalleatus.*

A I*b*. Base of body-whorl strongly swollen, more or less saccate to the left of the columella.

4. Nepionic riblets broad, strong, curved, the intervals slightly wider than a riblet below the suture, but spreading apart downward. No microsculpture of minute vertical striolae on body-whorl. Aperture semi-elliptical, the outer lip moderately arched. *S. maximus,* with subsp. *vestitus* and subsp. *huascari.*

5. Similar to *maximus,* but nepionic riblets more crowded, nearly parallel. Aperture very wide, with strongly convex outer lip. *S. popelairianus.*

6. Similar to *popelairianus* and *maximus,* but nepionic riblets somewhat lower and farther apart. Body-whorl very densely covered with microscopic, vertical striolae of the periostracum; more or less marked with zigzag areas of discolored or flaked periostracum. Aperture as in *popelairianus. S. valenciennesii.*

7. Nepionic riblets as in *valenciennesii.* Body-whorl with the microscopic striolae of that species. Aperture more semi-elliptical, the outer lip moderately arched. No zigzag markings of scarred periostracum. *S. terrestris,* with subsp. *oosomus,* subsp. *gummatus,* and subsp. *oliveirai.*

A II. Shell broadly or elongate elliptical, often more or less spindle-shaped, widest about mid-length. Spire scarcely or not more tapering than base, which is not saccate to the left of the columella. Aperture more or less oblique, the lower edge of the columella frequently much to the left of the vertical axis of the shell.

8. Nepionic riblets similar to those of *oblongus,* but narrower and more crowded, the intervals about as wide as a riblet. Body-whorl with strong growth-striae. Shell broadly elliptical, with very short spire and rounded, somewhat flattened summit. *S. capillaceus.*

9. Nepionic riblets as in *capillaceus.* Shell narrowly spindle-shaped, with much higher and narrower spire than in *capillaceus,*

particularly at the penultimate whorl. Body-whorl with very weak growth-striae, more or less malleate. *S. separabilis.*

10. Nepionic riblets much as in *capillaceus* and *separabilis,* but more pronounced. Differs from *separabilis* mainly in the more obese outline, the somewhat broader spire, with a more pointed summit. *S. carrikeri.*

11. Nepionic riblets very strong and regular, about as wide as their intervals. Shell elongate elliptical, with moderately raised spire and bluntly rounded summit. *S. leucostoma,* with subsp. *lacunosus.*

12. Very close to *leucostoma,* but with the nepionic riblets irregularly spaced and often with incomplete riblets in the intervals. Body-whorl more obese. *S. santa-cruzii.*

13. Similar to *leucostoma,* but with slightly narrower and more crowded riblets, which continue even to the penultimate and body-whorl. Shape of shell and of aperture as in *granulosus. S. sanctipauli,* with subsp. *pygmaeus* and subsp. *eyerdami.*

14. Nepionic riblets very strong, wide, far apart, complete, the intervals two to three times the width of a riblet. Shell elongate spindle-shaped, with moderately raised spire and bluntly pointed summit. *S. yporanganus,* with subsp. *toriii.*

A III. Shell very short and wide, globose-ovate, with broadly rounded and flattened summit.

15. Nepionic whorls mostly with broad and low, evenly spaced riblets, about as wide as their intervals. No granulation anywhere. Columella narrow, strongly arched. Outer lip slightly thickened, scarcely or not reflexed. Small, 35 to 42 mm. long, of 4⅓ to 4⅔ whorls. *S. globosus.*

B. Nepionic riblets few, broad, low, often irregularly spaced, continuous from suture to suture at most over the second whorl only, after which they tend to fade away on the lower part of the whorl.

16. Nepionic riblets about as wide as their intervals on the second whorl. Shell broadly spindle-shaped. Body-whorl moderately convex, not saccate at left base. Aperture ear-shaped, lower edge joining columella at right angle; outer lip nearly straight in the middle, bearing a strong, elongate swelling on the inner edge; parietal wall usually humped. *S. auritus.*

17. Nepionic riblets as in *auritus.* Shell very broadly elliptical, with strongly convex body-whorl, not saccate at left base. Aperture semielliptical, lower edge evenly rounded in columella; outer lip not straightened in the middle, without or with very weak swelling on the

inner edge; parietal wall not distinctly humped. *S. ovatus*, with subsp. *chionostoma* and subsp. *grandis.*

18. Nepionic riblets very few and far apart, the intervals twice as wide as a riblet on the second whorl. Shell broadly spindle-shaped. Body-whorl moderately convex, not saccate at left base. Aperture semi-elliptical, lower edge evenly rounded in columella; outer lip not straightened in the middle, not swollen on inner edge; parietal wall not humped. *S. bronni*, with subsp. *pergranulatus* and subsp. *fragilior.*

19. Nepionic riblets about as in *auritus* and *ovatus*. Shell broadly to elongate elliptical, but spire more attenuated than base. Body-whorl flattened convex, somewhat saccate at left base, usually strongly granulose. Aperture semi-elliptical, lower edge rather abruptly rounded in columella; outer lip not straightened nor swollen in the middle; parietal wall not humped; columella more or less arched. *S. granulosus*, with subsp. *abbreviatus*, subsp. *paranaguensis*, and subsp. *foreli.*

20. Similar to *granulosus*, but nepionic riblets slightly stronger and somewhat more crowded. Shell elongate spindle-shaped, spire scarcely more attenuated than base. Body-whorl narrow, not saccate at left base. Columella nearly straight; aperture otherwise as in *granulosus*. *S. proclivis.*

STROPHOCHEILUS (MEGALOBULIMUS) OBLONGUS (O. F. Müller)

The common *S. oblongus* is characterized by the sculpture of the nepionic whorls and the raised, bluntly pointed summit of the spire. In newly hatched shells, first one and a half whorls smooth; next whorls with slightly slanting vertical riblets, continuous from suture to suture; about mid-height on the third whorl, the intervals between riblets are about twice the width of a riblet (nearly one mm. on the average). Post-nepionic whorls with similar riblets, but gradually farther apart and coarser, and with much weaker granulation. Body-whorl of adult shells usually more irregularly wrinkled vertically and scarcely granulose. The microsculpture weathers or wears off with age, so that even living specimens may lack it almost completely, and it is generally absent in dead and subfossil shells. Adult shell of 6 to 6½ whorls in most races, normally broadly ovate, with the lower half wider than the spire, which tapers at the summit to a blunt point; nepionic whorls well raised above one another in front view; in a few races outline either more ovate-elliptical or ovate-conical. Body-whorl narrow at the base, not saccate to the left of the columella. Umbilicus usually indicated by a narrow open slit, in old age often completely closed. Aperture as a rule semi-elliptical, more or less oblique, often decidedly so, broadly and evenly rounded at the base, narrowed at the junction of parietal wall and outer lip. Parietal wall calloused in old age, rarely somewhat gibbose near upper end (very strongly so in one specimen of subsp. *haemastomus*). Rim of outer lip at first merely reflexed and moderately thickened, increasing in thickness with age by additional deposits of lime. In some races these accretions are considerable, the lip being sometimes 10 to 16 mm. wide behind the rim in subsp. *haemastomus*. Periostracum of young shells very thin, yellowish-brown with vertical streaks of darker brown, rapidly lost with age, adult living shells being normally pale dull brownish to dirty-white, occasionally with an indefinite paler band below the suture. Aperture whitish within; outer lip, columella and parietal callus in most races bright pink or rose-red in life.

Synopsis of Subspecies. As is so often the case for common and widespread terrestrial mollusks, the shell of *S. oblongus* is very variable, particularly in size, texture and shape of aperture, and somewhat less in outline, sculpture and color. Extreme variants may, however, be recognized as *oblongus* by the nepionic riblets.

Nine forms are here distinguished by names, all being given subspecific status for purely nomenclatorial reasons, while I am fully aware that they are not all of the same value. Some, like *haemastomus*, *lorentzianus*, and perhaps *albus*, appear to be caused by genetic differences inherited more or less regularly within a population in a given area, hence somewhat geographically segregated and covered by the customary definition of a subspecies. Others may be due directly to the environment or even be extreme individual variants or abnormalities. Finally for some of them too few specimens are known to allow even a guess as to their true nature.

a. Typical *S. oblongus*. Includes large, broadly oval specimens (70 to 137 mm. long and 40 to 83 mm. in greatest width), widest near mid-length, light or moderately heavy even in old age. Outer lip generally simple, expanded and slightly swollen; exceptionally somewhat thickened or moderately accrescent (rarely over 5 mm. wide behind the rim). Shell of various shades of pale brown; outer lip, columella and parietal wall normally bright pink (rarely somewhat faded in life or pinkish only on the upper part of the columella and the adjoining area of the parietal wall). Found over most of the range of the species, even where some of the other subspecies occur.

b. *S. oblongus albus* (Bland and Binney). Size and shape of typical *oblongus,* but usually somewhat lighter in texture. Pure white, sometimes covered with a very thin, yellowish periostracum (often worn off); outer lip, columella and parietal wall pure white. An albino form apparently hereditary in a few localities of the continent and the only race known from Tobago.

c. S. oblongus albescens, new name. Agreeing with *S. o. albus,* except that the outer lip is rose-pink. A little known part albino.

d. S. oblongus haemastomus (Scopoli). Medium-sized (63 to 111 mm. long and 35 to 62 mm. wide), shaped like typical *oblongus,* but thicker and heavier in life. Rim of outer lip strongly accrescent in old age, producing a broad varix (up to 16 mm. wide) of successive layer-like accretions of lime. Color of shell and peristome as in typical *oblongus.* Restricted to Uruguay and certain areas of northern Argentina and southern Brazil.

e. S. oblongus perelongatus, new subspecies. Unusually large and elongate (135 mm. long and 66 mm. wide), the penultimate whorl relatively broader than usual. Texture, sculpture and color of shell and of peristome as in typical *oblongus.* Known only from the Upper Orinoco drainage in Colombia.

f. S. oblongus elongatus, new subspecies. Medium-sized (73 to 84 mm. long and 39 to 45 mm. wide), narrower and with relatively higher spire than either typical *oblongus,* subsp. *haemastomus,* or subsp. *musculus.* Heavy and thick, usually with the outer lip accrescent in old age; surface of shell more strongly granulose than usual. Color of shell and of peristome as in typical *oblongus.* Known only from Uruguay and Paraguay.

g. S. oblongus conicus, new subspecies. Medium-sized (68 to 103 mm. long and 40 to 55 mm. wide), ovate-conical, widest much below mid-length. Heavy, with the accrescent outer lip, sculpture and color of subsp. *haemastomus.* Known only from the states of Bahia and Maranhão in Brazil.

h. S. oblongus lorentzianus (Döring). Medium-sized, usually broader relatively to the length than either typical *oblongus* or subsp. *haemastomus* (72 to 100 mm. long and 42 to 62 mm. wide), of normal thickness. Only 5 to 5½ whorls, with the summit of the spire wider and more obtuse. Rim of outer lip not or slightly thickened in old age. Body-whorl with coarser rib-striae than in typical *oblongus.* Color of shell and of aperture as in typical *oblongus,* but the paler subsutural band usually lacking. Seemingly restricted to a small area in northwestern Argentina and the adjoining section of southern Bolivia.

i. S. oblongus musculus, new subspecies. Small to medium-sized

(52 to 85 mm. long and 32 to 49 mm. wide), with the shape, light texture, sculpture, and color of shell and aperture of subsp. *lorentzianus*. Outer lip not or slightly accrescent. Spire short and broad, with very obtuse summit. A dwarf race, seemingly rather constant in certain areas of northern Argentina and Paraguay.

Distribution. The several races of *S. oblongus* inhabit the major part of South America, from Colombia to Uruguay and northern Argentina. There are, however, no fully reliable records from Chile, Peru, Ecuador, the Pacific section of Colombia, and Panama.[1] In the West Indies, the species is, in my opinion, indigenous only in Trinidad and Tobago, which may be considered as part of the South American continent. It occurs only sporadically in the Antilles proper, where it was no doubt introduced originally by man, as an article of diet. Bland (1861) states that it was brought from St. Vincent to Barbados by one Mr. J. Parkinson. As early as 1786, Chemnitz wrote that by some it was claimed to occur in Jamaica, but it was only rediscovered there in recent years (Dean, 1928; Ford, 1945). Solander (1786) reported it at an early date from St. Vincent, where, nevertheless, it appears to have been introduced. Bruguière (1789) recorded it from St. Thomas, R. J. L. Guppy (1881) from Grenada and St. Vincent, and E. A. Smith (1894) from St. Thomas and Grenada. I have seen specimens from Antigua, and Dall (1894) stated that it had been introduced from there into St. Kitts. It also occurs in St. Lucia. Moreover, the present wide distribution on the continent may well be partly due to the agency of man.

Ethology. The typical form and some races of *S. oblongus* are frequently found in gardens or close to human habitations. The snail is strictly terrestrial and nocturnal in habit. In the morning it burrows under loose earth in protected places, for concealment from enemies and protection against the tropical sun. Only the apex of the shell protrudes more or less. It buries itself much deeper for estivation during the dry season. According to Drouët (1859), in French Guiana it oviposits at the first rains following a dry spell. The egg, which has been described and figured several times, is unusually large, broadly elliptical in outline, reaching 25 to 28 mm. in length and 16 to 17 mm. in width, and is pure white (Pl. 32, fig. 8). In captivity some 10 to 12 eggs are laid at one time, usually over a period of a few hours. Ford (1945) observed that in nature the eggs are laid during the daytime,

[1] Mousson's (1870) record of *S. oblongus* from Peru, at 2,000 ft., appears open to question, as he may have confused *S. capillaceus*. *Helix serpentina* Molina (1782, Saggio Storia Naturale Chili, p. 205) has sometimes been cited in the synonymy of *S. oblongus*; but, as Gigoux (1930, Rev. Chilena Hist. Nat., **33**, 1929, p. 467) pointed out, it was no doubt *Macrocyclis laxata* (Férussac).

while the snail is mostly hidden in the soil. The egg hatches after about 3 to 4 weeks into a young shell about the same size and almost transparent. Drouët found that in captivity the shell takes about 32 months to become fullgrown, with completely formed outer lip. Once this is formed the shell does no longer increase in length, but it may thicken the outer lip by successive deposits of shell matter. These accretions are rather exceptional in the typical form and in the subspecies *albus, albescens, musculus, lorentzianus,* and *perelongatus,* either because these races usually live under ecological conditions adverse to the excretion of lime or because they only rarely attain a ripe age. A broad accrescent outer lip is commonly produced by the subspecies *haemastomus, elongatus,* and *conicus.* d'Orbigny (1837) assumed that in such cases a new layer was added to the rim every year, and from shells with well-defined layers, he estimated that some individuals lived up to ten years. On the same basis, Albers (1850) calculated that one of his specimens had lived 14 years. There is, however, no real evidence, either observational or experimental, that each layer corresponds to one year's growth. It can only be stated in general that the widened rim of the outer lip is a sign of old age. The successive layers of the rim are best traced on the back portion of the lip, near the body-whorl.

Some years ago I called attention to the peculiar commensalism of a coprid beetle, *Zonocopris bucki* Arrow, and *S. oblongus* (1935, The Nautilus, **49**, pp. 35–36). This seems to have been first observed by Hensel in Brazil, as reported by J. P. E. Stein in 1867 (Berlin. Entom. Zeitschr., **11**, p. 212): "Dr. Hensel frequently found on a large species of *Bulimus* a small beetle related to the genus *Onthocharis* Dej., feeding on the mucus secreted by the snail and commonly withdrawn under the mantle in the shell when the animal retracts. Dr. Hensel established that this beetle was not accidentally stuck to the mucus, as he observed distinctly how some specimens, after being kept without food for a few days, ate the mucus with avidity when placed on a live *Bulimus.*" In 1868, E. von Martens also mentioned the association of live *S. oblongus* in southern Brazil with "a black beetle of the family of *Geotrupes*" (Malak. Blätt., **15**, p. 177). In 1932, G. J. Arrow described this beetle from specimens collected by P. Buck on *S. oblongus* in the state of Espírito Santo (Stylops, **1**, pp. 223–224) and from others obtained in Paraguay. As many as 12 of the beetles were found within a single shell by P. Buck.

a. Typical OBLONGUS

Pl. 23, fig. 5; Pl. 28, fig. 1; Pl. 32, fig. 8

[Lister, 1685, Synopsis Meth. Conchyl. Liber Primus, Pl. 23, fig. 21 (adult and young shell; egg; Surinam); 1699, A Journey to Paris in the year 1698, Pl. 3 (figures of animal, supposedly from Hispaniola, labelled "*Cochlea terrestris americana*," after a drawing by F. Plumier)].

[Seba, 1758, Rer. Nat. Thesaurus, **3**, p. 169; Pl. 71, figs. 17–20 (no locality)].[1]

[Davila, 1767, Cat. Syst. Raisonné Curios., **1**, p. 134 ("Fausse oreille de Midas"; Cayenne)].

[Favart d'Herbigny, 1775, Dictionnaire Hist. Nat., **2**, p. 29 ("fausse oreille de Midas"; Cayenne; Guiana; Surinam)].

[P. L. S. Müller, 1775, in Linné, Vollständ. Natursyst., **6**, pt. 1, p. 463 (eggs: "Kinkhörnereyer"); Atlas to vol. **6**, Pl. 16, fig. 2].

[Walch, 1778, Der Naturforscher, **12**, p. 6; Pl. 1, figs. 1–3 (egg and young shell; Surinam)].

[Favanne, 1780, in d'Argenville, La Conchyliologie, 3d Ed., Pl. 65, fig. I, 1, and Pl. 80, fig. P (young shell in egg)].

[J. S. Schröter, 1784, Einleitung Conchylienkennt., **2**, p. 180 (No. 8, Lister's Pl. 23, fig. 21)].

[Chemnitz, 1786, Syst. Conch. Cab., **9**, pt. 2, p. 30; Pl. 119, figs. 1022–1023 (with reference to *Helix oblonga* Müller; but the figured specimen, from Chemnitz' Collection, was not Müller's type; no definite locality; earlier localities repeated, with the addition that some claim it occurs in Jamaica)].

Helix oblonga O. F. Müller, 1774, Verm. Terr. Fluv. Hist., **2**, p. 86 (description of a shell in Fabricius' Collection; references to Lister, Syn., t. 23, f. 21; and Seba, Thes., **3**, t. 71, figs. 17–20; no locality). Born, 1780, Test. Mus. Vindobonensis, p. 381; Pl. 15, figs. 21–22. Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., **1**, pt. 6, p. 3637. Röding, 1798, Museum Boltenianum, pt. 2, p. 106; 1819, *Op. cit.*, 2d Ed. (by J. Noodt), p. 75. Dillwyn, 1817, Descr. Cat. Recent Shells, p. 931 (St. Vincent, according to Humphreys). Wood, 1818 (and 1825), Index Testaceologicus, p. 162 (with references to Lister's, Born's, and Chemnitz' figures; not his Pl. 34, fig. 102).

Bulimus oblongus Bruguière, 1789, Encyclop. Méthod., Vers, **1**, pt. 1, p. 318 (Cayenne and the island of St. Thomas supposedly on the coast of Africa; evidently a confusion of St. Thomas in the West Indies with S. Thomé in the Gulf of Guinea). Bosc, 1802 (An X), Hist. Nat. Coq., **4**, p. 203. d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 297 (text in part; specimens from Bolivia: between Sa. Cruz de la Sierra and Chiquitos; not the figures). Potiez and Michaud, 1838, Gal. Moll. Douai, **1**, p. 148. Porro, 1846, Coll. Mus. Modiol., Moll. Terr. Fluv., p. 14. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 35, fig. 210. Pfeiffer, 1848, Monogr. Helic.

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[1] Bruguière (1789, Encyclop. Méthod., Vers, **1**, pt. 1, p. 319) claimed that Seba's figures 18 and 19 represent *S. ovatus*, not *S. oblongus*. I am unable to agree with him, as all four of Seba's figures look to me like *S. oblongus*.

Viv., **2**, p. 21 (in part; not the varieties). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 203. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 34 (in part; not the figures cited). Bland, 1852, in C. B. Adams, Contrib. to Conchol., No. 11, p. 229 (Colombia: Santa Ana; Villeta; Méndez). Pfeiffer, 1853, Monogr. Helic. Viv., **2**, pp. 304 and 651. S. P. Woodward, 1854, Man. of Mollusca, pt. 2, p. 164, and p. 12 of Expl. of Plates; Pl. 12, fig. 10. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146 (in part); Pl. 74, fig. 5*a* (only: shell). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 26 (in part: Guiana; Paraguay; not the variety from Bolivia). v. Martens, 1859, Malak. Blätt., **6**, p. 61 (Venezuela: Ejido near Mérida). Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366. Bland, 1861, Ann. Lyc. Nat. Hist. New York, **7**, pts. 10–12, pp. 351, 359 and 360 (St. Vincent; Tobago; Trinidad; introduced in Barbados). A. D. Brown, 1861, Cat. Shells Coll., p. 47; 1866, *Op. cit.*, 2d Ed., p. 58. Guppy, 1866, Proc. Scient. Assoc. Trinidad, **1**, p. 16; 1866, Ann. Mag. Nat. Hist., (3), **17**, p. 48 (Trinidad; anatomy). Kriechbaumer, 1866, Malak. Blätt., **13**, p. 142 (type of *Ampullaria rosea*). Heynemann, 1868, Malak. Blätt., **15**, p. 107; Pl. 5, figs. 7*a-b* (jaw; radula). Haines, 1868, Cat. Terr. Shells Coll., p. 52. Bland, 1868, Amer. Jl. Conch., **4**, p. 182. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 10. v. Martens, 1868, Malak. Blätt., **15**, p. 176 (Brazil: Rödersberg, Est. Rio Grande do Sul; Porto Alegre, Est. Espírito Santo). Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 43 (Uruguay). Guppy and Hogg, 1870, Trans. Linn. Soc. London, **26**, p. 192. Mousson, 1870, Malak. Blätt., **16**, (1869) p. 174 (Peru, at 2,000 ft.).[1] S. P. Woodward, 1871, Man. of Mollusca, 2d Ed., p. 291; Pl. 12, fig. 10 (later editions are reprints of 2d Ed.). Guppy, 1872, Proc. Scient. Assoc. Trinidad, **2**, pt. 1, p. 23. Hidalgo, 1872, Moluscos del Viaje al Pacífico, **1**, p. 52. Paetel, 1873, Cat. Conch.-Samml., p. 98. Döring, 1874, Periódico Zoológico, **1**, pt. 2, p. 114. Guppy, 1875, Proc. Zool. Soc. London, p. 320; 1875, Quart. Jl. Conch., **1**, pt. 7, p. 109. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 13; 1877, *Op. cit.*, **8**, p. 604. Ernst, 1877, Estudios Fauna Flora Venezuela, p. 326. Brauer, 1878, Sitzungsber. Ak. Wiss. Wien, Math.-Naturw. Kl., **77**, Abt. 1, p. 182 (Born's shell). Kobelt, 1880, Jahrb. D. Mal. Ges., **7**, pp. 284 and 285. Guppy, 1881, Proc. Scient. Assoc. Trinidad, **2**, pt. 4, p. 166 (St. Vincent. Grenada. Trinidad). Leunis, 1883, Synopsis d. Thierk., 3d Ed. (by H. Ludwig), **1**, p. 887. v. Martens, 1885, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 147 and 148 (Brazil: Piracicaba, Est. São Paulo; Descalvado, Est. Matto Grosso). Wohltmann, 1890, Zeitschr. Ges. Naturw., **63**, p. 307 (Brazil: Bay São Francisco do Sul, Est. Santa Catharina; subfossil). Crosse, 1890, Jl. de Conchyl., **38**, p. 40 (Trinidad: Port of Spain). Quelch, 1890, Timehri, Jl. Agr. Comm. Soc. Brit. Guiana, (N. S.), **4**, pp. 40 and 43. Rush, 1891, The Nautilus, **5**, pp. 65 and 69 (Barbados: Bridgetown). Guppy, 1892, Proc. Zool. Soc. London, p. 271; 1893, Jl. of Conchol., **7**, pt. 7, p. 218; 1894, Proc. Victoria Inst. Trinidad, **1**, p. 30. Dall, 1894, The Nautilus, **8**, p. 35 (St. Kitts, introduced from Antigua). E. A. Smith, 1894, Proc. Mal. Soc. London, **1**, pt. 3, p. 137 (Grenada. St. Thomas); 1895, *Op. cit.*, **1**, pt. 7, pp. 306 and 317. Robinson, 1895, A Flying Trip to the Tropics, p. 80, fig. (Colombia: Yeguas [now La Dorada], Dept. Caldas). Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 89, 196 and 318. Corsi, 1900, An. Mus. Nac. Montevideo, **2**, pt. 16, p. 404 (Uruguay: Dept. Maldonado). Boman, 1908, Antiquités Région Andine République Argentine, **2**, p. 842 (Argentina: in Indian burying grounds, Arroyo del Medio, Sierra Santa Bárbara, Jujuy). Teisseire, 1930, Arch. Soc. Biol. Montevideo, Suppl. 1, p. 225 (Uruguay: Colonia).

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[1] The only record of the species from Peru; possibly misidentified.

Helix (or *Bulimus*) *oblonga* Brookes, 1815, Introduction Study Conchol., pp. 9, 129, and 163; Pl. 8, fig. 108.

Cochlogena oblonga Sowerby, 1825, Cat. Coll. Earl Tankerville, p. 39.

Helix (*Cochlogena*) *oblonga* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 55 (Trinidad; Brazil); 1827, Bull. Sci. Nat. Géol., **10**, p. 305 (French Guiana: Cayenne). d'Orbigny, 1835, Mag. Zool., **5**, Class V, No. 61, p. 16 (in part only; some of the localities refer to var. *haemastomus*). Moricand, 1841, Mém. Soc. Phys. Hist. Nat. Genève, **9**, pt. 1, p. 59 (Brazil: Serra Jacobina, Est. Bahia).

Bulimus (*Bulimus*) *oblongus* Beck, 1837, Index Moll., pt. 1, p. 52 (in part). Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27; 1857, Cat. Conchyl. Suenson, p. 8. Drouët, 1859, Mém. Soc. Acad. Aube, **23**, p. 354 [Essai Moll. Guyane Française, p. 58] (French Guiana: common in the coastal districts at Cayenne, Ilet-la Mère, etc.); Pl. 2, figs. 25-26 (young shell; egg).

Bulimus (*Borus*) *oblongus* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191. v. Martens, 1873, Festschr. Ges. Naturf. Fr. Berlin, pp. 171 and 214 (Venezuela: Lake Valencia; Puerto Cabello; Caracas; Caripe near Cumana; Ejido). Semper, 1874, Reisen Arch. Philippinen, pt. **2**, vol. **3**, fasc. 3, p. 150; Pl. 14, fig. 10; Pl. 16, fig. 25; Pl. 17, fig. 1 (anatomy; jaw; radula). v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 17. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 121. P. Fischer, 1883, Manuel Conchyliologie, p. 472; Pl. 12, fig. 10. H. v. Ihering, 1884, Zeitschr. Wiss. Zool., **41**, pp. 270, 273 and 277; Pl. 17, fig. 6 (anatomy; on p. 277 and in Expl. of Plates, p. 283, the name *B. ovatus* is used presumably by oversight). v. Martens, 1885, Conchol. Mitth., **2**, pts. 3–4, p. 157 (Colombia: Muzo, 600 to 800 m.; valley of Magdalena River, 500 m.; Ibagué, 1,280 m.; Puenta de Pandi, 779 m. Brazil: Rio Tocantins near Baiâo. Uruguay: a variety from Arroyo Vijiga, Montevideo). Clessin, 1888, Malak. Blätt., (2), **10**, p. 167 (Brazil: Taquara del Mundo Novo, Est. Rio Grande do Sul). E. A. Smith and Feilden, 1891, Ann. Mag. Nat. Hist., (6), **8**, p. 251 (Barbados). Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119. H. v., Ihering, 1891, Bull. Scientif. France Belgique, **23**, p. 213; Pl. 5, figs. 11A-B.

(anatomy). Paravicini, 1894, Boll. Mus. Zool. Anat. Comp. Torino, **9**, No. 181, p. 5 (Paraguay: Río Apa; S. Pedro; Asunción). H. v. Ihering, 1894, Arch. f. Naturgesch., **60**, pt. 2, p. 38 (Brazil: Bolassa, Est. Rio Grande do Sul, in old Indian kitchen-middens).

Borus oblongus Mörch, 1863, Cat. Conchyl. Lassen, p. 4; 1865, Jl. de Conchyl., **13**, p. 385 (jaw). Bland, 1866, Amer. Jl. Conch., **2**, pp. 356 and 366. Jousseaume, 1889, Mém. Soc. Zool. France, **2**, p. 242 (Venezuela: Valencia). Semper and Simroth, 1894, Reisen Arch. Philippinen, pt. 2, vol. **3**, Ergänzungsheft 2, pp. 52 and 53 (anatomy). Ancey, 1897, Boll. Mus. Zool. Anat. Comp. Torino, **12**, No. 309, pp. 5 and 12 (Bolivia: San Francisco Mission on Upper Pilcomayo River). Nordenskiöld, 1903, Svenska Vet. Ak. Handl., **36**, No. 7, pp. 12 and 21; Pl. 2 (Argentina: in old Indian burying grounds, Sierra Santa Barbara, Jujuy). Standen, 1917, Jl. of Conchol., **15**, pp. 159 and 164 (egg).

Strophocheilus (*Borus*) *oblongus* Pilsbry, 1895, Man. of Conch., (2), **10**, pp. 29 and 196; Pl. 14, figs. 71 (after Reeve), 72 and 73 (specimen) (Brazil: Mocambo; Pará; Corumbá); 1896, *Op. cit.*, (2), **10**, p. 196; 1901, *Op. cit.* (2), **14**, p. 122 (Colombia: Bonda, 8 mi. S.E. of Santa Marta. Brazil: Cuyabá. Uruguay: Fray Bentos); 1902, *Op. cit.*, (2), **14**, Classification, p. v. Dautzenberg, 1900, Mém. Soc. Zool. France, **13**, p. 150 (Venezuela: Yacua). L. B. Brown, 1903, Jl. of Conchol., **10**, pt. 9, p. 268. F. Baker, 1914, Proc. Ac. Nat. Sci. Philadelphia, (1913), p. 634 (Brazil: Serra de Ibiapaba, Est. Ceará; Rio Maccurú or Maycurú, Est. Pará). A. Weber, 1925, Zool. Jahrb., Abt. Syst., **50**, p. 280 (Brazil: Pilão Arcado on San Francisco River, and Serra de S. José, Est. Bahia; Serra Geral de Goyaz, Est. Goyaz). H. B. Baker, 1926, Occ. Papers Mus. Zool. Univ. Michigan, No. 167, p. 22; Pl. 15, figs. 78A–L (anatomy. Venezuela: Bejuma; Palma Sola; Boquerón; La Fría). Winkle, 1926, Proc. Mal. Soc. London, **17**, pt. 1, p. 4 (egg). Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 45. Martins, 1945, Rev. Mus. Nac., Rio de Janeiro, **2**, p. 19, fig. (living animal).

Strophochilus (*Borus*) *oblongus* E. A. Smith, 1896, Jl. of Conchol., **8**, pt. 7, p. 240.

Strophocheilus oblongus Pilsbry and Rush, 1896, The Nautilus, **10**, p. 78 (Uruguay: Fray Bentos). Pilsbry, 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 390. Vernhout, 1914, Notes Leyden Mus., **36**, p. 10 (Dutch Guiana: Paramaribo; Post Groningen). H. v. Ihering, 1915, Commissão Linhas Telegr. Matto Grosso Amazonas, Annexo 5, Molluscos, p. 7 (Brazil: Caceres; Rio Jaurú; Porto Espiridião; Salitre; Fumaça; Salto Alegre; all Est. Matto Grosso). Vanatta, 1915, The Nautilus, **29**, p. 82 (Venezuela: Cariaquito). Bertoni, 1926, Rev. Soc. Cientif. Paraguay, **2**, pt. 1, (1925), pp. 71 and 72 (Paraguay: Alto Paraná). Jaeckel, 1927, Zoolog. Anzeiger, **72**, p. 36 (Brazil: Sa. Rosa on Uruguay River, Est. Rio Grande do Sul). J. D. Dean, 1928, Jl. of Conchol., **18**, p. 200; Pl. 3 (Kingston, Jamaica; photograph of live snail). Schlesch, 1928, Actes Soc. Linn. Bordeaux, **80**,

p. 132. Felippone and Barattini, 1938, Bol. Servicio Oceanográfico, Montevideo, **1**, pt. 1, p. 56 (Uruguay: common, particularly in the northern departments). P. D. Ford, 1945, Amer. Malac. Union, News Bull. Ann. Rept., (1944–1945), p. 5 (habits in Jamaica).

Bulimus (*Strophochilus*) *oblongus* Arrow, 1932, Stylops, London, **1**, p. 224 (Brazil: Porto Alegre, Est. Espirito Santo).

Strophocheilus (*Megalobulimus*) *oblongus* Schlesch, 1934, Arch. f. Molluskenk., **66**, p. 47 (Paraguay: Villarrica). Haas, 1939, Senckenbergiana, 21, p. 269 (Brazil: between Brejo and Curimatahú; Cariry: between Pocinhos and Campina Grande; Soledade; all in Est. Parahyba).[1]

Strophocheilus (*Megabulimus*) *oblongus* Haas, 1935, Arch. f. Molluskenk., **67**, p. 110 (Brazil: Soledade, Est. Parahyba).

Strophochilus oblongus J. Bequaert, 1935, The Nautilus, **49**, p. 35, (Brazil: Tres Lagôas, Est. Matto Grosso).

Lophocheilus oblongus Hermano Daniel, 1942, Rev. Acad. Colombiana Cienc. Exact. Fis. Nat., **4**, Nos. 15–16, (1941), p. 376; Pl. 2, fig. 95A (Colombia: La Ceja and Andes, Dept. Antioquia).

Helix ovipara Solander, 1786, Cat. Portland Museum, p. 174 (St. Vincent; with reference to Lister, Pl. 23). See W. H. Dall, 1921, The Nautilus, **34**, p. 99.

Bulla? occidua G. Shaw, 1797, Naturalist's Miscellany, **8**, Pl. 294 (name on first unnumbered page of letterpress; shell, animal, egg; no locality).

Bulimus hemastomus de Roissy, 1805 (An XIII), Hist. Nat. Moll., **5**, p. 336.

Bulimus roseus de Montfort, 1810, Conchyl. Systém., **2**, p. 259; Pl. 65 (with description and references).

? *Melania carnatis* Perry, 1811, Conchology, Pl. 29, fig. 3 (with description in letterpress; "East Indies"; unrecognizable).

Bulimus haemastomus Leach, 1814, Zoolog. Miscellany, **1**, p. 68; Pl. 29 (2 figs.). de Blainville, 1817, Dict. Sci. Nat., **5**, p. 127; 1824, *Op. cit.*, **32**, p. 248. Guilding, 1824, Trans. Linn. Soc. London, **14**, pt. 2, p. 340; 1824, Zool. Journ., **1**, p. 131. de Blainville, 1825, Man. Malac. Conch., p. 455. Guilding, 1825, Zool. Journ., **2**, No. 8, p. 440 (St. Vincent; animal, egg); Suppl. Pl. 16*bis*, figs. 1–4; 1829, in Oken's Isis, pt. XII, p. 1289; 1832, *Op. cit.*, pt. III, p. 334; Pl. 3, figs. 1*a*-*b*. Menke, 1828, Synops. Meth. Moll., p. 14; 1830, *Op. cit.*, 2d Ed., p. 25. Turpin, 1832, Ann. Sci. Nat., **25**, p. 434 (egg). Lesson, 1832, Centurie Zoologique, p. 223; Pl. 77 (in part: shell only). de Cristofori and Jan, 1832, Conspect. Meth. Moll., Pars 1, fasc. 1, Dispos. Method., p. 4. Oken, 1835, Allgemeine Naturgeschichte, **5**, pt. 1, p. 424. Jay, 1835, Cat. Shells Coll., p. 30; 1836, *Op. cit.*, 2d Ed., p. 40. 1839, *Op. cit.*, 3d Ed., p. 56; 1850, *Op. cit.*, 4th Ed., p. 198. Voigt, 1837, Lehrb. d. Zool., **3**, p. 392. Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 222; 1844, *Op. cit.*, 3d Ed., **3**, p. 348. Pfeiffer, 1840, Krit. Register Konch.-Kab., p. 84. Küster, 1841, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 5; Pl. 1, figs. 3–4. A. and J. B. Villa, 1841, Dispos. Syst. Conch.

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[1] According to Dr. F. Haas (*in litt.*, 1947), No. 47 listed as one of his localities for *S. oblongus* was a misprint for No. 41.

Terr. Fluv., p. 20. Leunis, 1844, Synopsis Drei Naturreiche, Zool., p. 373. Troschel, 1848, in Rich. Schomburgk, Reisen in Britisch Guiana, **3**, p. 546 (jaw and radula. British Guiana: Upper Takutu). Robert Schomburgk, 1848, History of Barbados, p. 659. Troschel, 1849, Arch. f. Naturgesch., **15**, pt. 1, p. 227; Pl. 4, figs. 1*a-d* (jaw and radula). Mrs. M. E. Gray, 1859, Figures Moll. Animals, **2**, Pl. 299, fig. 1 (after Lister, 1699); *Op. cit.*, **4**, p. 58. Leach, 1845, Mélanges Zoologiques, in Chenu, Bibliothèque Conchyliologique, p. 11; Pl. 4, fig. 3. Not of Scopoli, 1786.

Helix (*Bulimus*) *haemastomus* Voigt, 1834, in Cuvier, Das Thierreich, **3**, p. 78.

Bulinus haemastoma Sowerby, 1835, Zool. Journ., **5**, No. 20, p. 496.

Bulimus (*Bulimus*) *haemastomus* Anton, 1839, Verzeichniss Conchyl.-Samml., p. 40.

Borus haemastoma Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (egg).

Bulimus hemostomus Wiener, 1876, Arch. Mus. Nac. Rio de Janeiro, **1**, pt. 1, p. 10 (Brazil: Est. Santa Catharina, in old Indian kitchen-middens. Misspelling of *haemastomus*).

Ampullaria rosea Spix, 1827, in Wagner, Test. Fluv. Brasiliam, p. 3; Pl. 4, fig. 3 (southern Brazil; based on a young *S. oblongus*, as recognized by Voigt, Menke, Kriechbaumer, and v. Martens).

Helix semilineata Menke, 1828, Synops. Meth. Moll., p. 75 (with description; no locality; based on a young *S. oblongus*, as recognized by Menke, 1830, *Op. cit.*, 2d Ed., p. 25).

Bulimus oblongus var. *semilineatus* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215.

Helix ovalis Wood, 1818 (and 1825), Index Testaceologicus, Pl. 34, fig. 101 (not the references on p. 162); 1856, *Op. cit.*, Hanley Ed., p. 169; Pl. 34, fig. 101. Not of Gmelin, 1790.

Bulimus ovatus Wood, 1828, Supplement Index Testaceologicus, p. 31. Hanley, 1840, Young Conchologist's Book Species, p. 32. Not of O. F. Müller, 1774.

Strophocheilus ovatus Kappler, 1887, Surinam, Land, Natur, etc., p. 204. Vernhout, 1914, Notes Leyden Mus., **36**, p. 10 (Dutch Guiana). Not of O. F. Müller, 1774.

Bulimus vaporeus Mousson, 1870, Malak. Blätt., **16**, (1869), p. 174 (South America, without more definite locality; collected by Wallis, probably in Colombia).

? *Strophocheilus* (*Borus*) *capillaceus* A. Weber, 1925, Zool. Jahrb., Abt. Syst., **50**, p. 279 (Brazil: São Disidério, Est. Bahia, in a cave at a depth of 70 m.; said to be 67 to 84 mm. long).

The type of *H. oblonga* may be yet in the Copenhagen Museum. I do not know whether the types of *ovipara* Solander, *occidua* Shaw, *roseus* de Montfort, *carnatis* Perry, *semilineata* Menke, and *ovalis* Wood were preserved. That of *rosea* Spix was in Munich, when Kriechbaumer examined it in 1866. The type of *vaporeus* Mousson is possibly at the Zurich Museum; the description and measurements fit well immature *S. oblongus*, a common snail in the region visited by Wallis.

Specimens Examined. Jamaica: Constant Spring (P. D. Ford.–M.C.Z.). — Antigua: (W. M. Branch.–M.C.Z.). — St. Lucia: (M.U Mich.) — St. Vincent: (U.S.N.M.; M.U.Mich.). — Barbados: (F. G. Kellett.–M.C.Z.; U.S.N.M.; C. W. Walter.–M.N.H.Chic.). Bridgetown (W. H. Rush.–M.C.Z.; M.U.Mich.). Bay Mansion Gardens (L. L. Brown.–M.U.Mich.) — Grenada: St. George (G. M. Allen.–M.C.Z.). — Colombia: Santa Ana near Mariquita, Dept. Tolima (T. Bland.–M.C.Z.). Cordillera de Bogotá (A. Moria.–M.U.Mich.). Meta River (Smith.–U.S.N.M.). Mobi (M.U.Mich.). Garzón, Dept. Huila (L. M. Murillo.–M.C.Z.). San Vicente de Chucurí, Dept. Santander Sur (J. Bequaert.–M.C.Z.). Sevilla, foot of Sierra Nevada de Sa. Marta (H. Pittier.–U.S.N.M.). Bogotá (M.C.Z.). Río Ocoa near Villavicencio, Int. Meta (L. Richter.–M.C.Z.). Nare, Rio Magdalena, Dept. Antioquia (L. Richter.–M.C.Z.). Armero, Dept. Tolima (L. M. Murillo.–M.C.Z.). Magdalena River valley, Dept. Caldas, 1200 m. (L. Richter.–M.C.Z.). Muzo, Dept. Boyacá (J. Bequaert.–M.C.Z.). Manzanares, Sa. Marta, Dept. Magdalena (H. N. Howland.–M.N.H. Chic.). Villavicencio, Int. Meta (J. Bequaert,–M.C.Z.). Río Frío, Dept. Magdalena (G. Salt.–M.C.Z.). Guamalito, 1,500–2,000 ft., Dept. Norte de Santander (M. A. Carriker, Jr.–U.S.N.M.). Ciénaga, Dept. Magdalena (R. Romero C.–U.S.N.M.). Río Sucio, Dept. Santander Sur (T. A. Link.–U.S.N.M.). Valley of the Río Ranchería (A.M.N.H.). Magdalena Valley, Dept. Santander Sur (O. Haught.–U.S.N.M.). 13 Kilom. S. of Puerto Santos, Dept. Norte de Santander (R. H. Palmer.–U.S.N.M.). Puerto Salgar, Río Magdalena (H. Dybas.–M.N.H.Chic.). — Venezuela: Bejuma (H. B. Baker.–M.U.-Mich.). Palma Sola (H. B. Baker.–M.U.Mich.). Concepción (M.U.-Mich.). La Fría (M.U.Mich.). Caracas (L. L. Brown.–M.U.Mich.; H. Pittier.–U.S.N.M.). Quebrada Calembe, Riecito, Est. Falcón (H. Kugler.–M.C.Z.). Tocuyo Valley, between Taparito and Guaidima, Est. Falcón (H. Kugler.–M.C.Z.). Puerto Cabello (M.C.Z.). Caripito (W. Beebe.–M.C.Z.). Tributary of Río Chama at Estanques, Est. Mérida (Schultz.–U.S.N.M.). Barquisimeto (H. Pittier.–M.N.H.Chic.). Maracay, Est. Aragua (N. Dearborn.–M.N.H.Chic.). 20 miles from Mérida (G. Artamanoff.–M.N.H.Chic.). Encontrados, Est. Zulia (N. Dearborn.–M.N.H.Chic.). Boquerón (H. B. Baker.–M.U.Mich.). Auyán-tepuí, 2,220 m. Est. Amazonas (Phelps Exped.–A.M.N.H.). Sierra Nevada Mts., 6,000 ft. (Gabaldon.–U.S.N.M.). Río del Palmar (Totuma), 100 kilom. W. of Maracaibo, Est. Zulia

(Schultz.-U.S.N.M.). East shore of Lake Maracaibo (Arnold.-U.S.N.M.). Grand Maracay, Est. Aragua (H. Pittier.-U.S.N.M.). Puebla de San Juan, 3,000 ft. (Gabaldon and Sono.-U.S.N.M.). El Menito, Bolivar District, Est. Zulia (L. W. Stephenson.-U.S.N.M.). 4 kilom. below Lagunillas, Río Chama Drainage, Est. Mérida (Schultz.-U.S.N.M.). 20 kilom. above the bridge on Río Machango, S.E. of Lagunillas, Est. Mérida (Schultz.-U.S.N.M.). Valera, Est. Trujillo (H. Pittier.-U.S.N.M.). — TRINIDAD: Pointe-à-Pierre (H. Kugler.-M.C.Z.). Marac Quarry (H. Kugler.-M.C.Z.). Port of Spain (M. D. Barber.-M.C.Z.). Tunapuna, St. Augustine (N. Weber.-M.C.Z.). 5 miles S.E. of Rio Claro Ortoire River (N. Weber.-M.C.Z.). Belmont near Port of Spain (M.C.Z.). — BRITISH GUIANA: Demerara (M.U.-Mich.; M.C.Z.). — DUTCH GUIANA [Surinam]: Post Groningen (D. C. Geijskes.-M.C.Z.). Kantani, western Paroe Savanna, near the Brazilian Border (L. Schmit.-M.C.Z.). Paramaribo (D. C. Geijskes.-M.C.Z.). — BRAZIL: Gurupy River, S. Belem, Est. Pará (Ac.N.S.Phila. R. Humes Collection). Between Salinas and Pará Vigia, Est. Pará (A. H. Fisher.-Ac.N.S.Phila.). Belem, Est. Pará (M.C.Z.). Santarem, Est. Pará (D. Bourget.-M.C.Z.). Igarapé Aniba, Est. Amazonas (A. M. Olalla.-M.C.Z.; T. and J. Burch Collection). Confluence of Rio Negro and Amazon, Est. Amazonas (A. Edwards.-U.S.N.M.). Mocambo, Est. Piauhy (A.N.S.Phila.). Est. Ceará (J. Schedel.-M.C.Z.). Bom Jardim near Lagôa Santa, Est. Bahia (Thayer Exped.-M.C.Z.). Est. Rio de Janeiro (F. Schade.-M.C.Z.; F. Stearns.-Ac.N.S.Phila.). Mt. Corcovado near Río de Janeiro (R. Humes Collection). Sorocaba, Ipanema, Est. São Paulo (M.C.Z.). Baurú, Est. São Paulo (E. Garbe.-M.C.Z.). Between Patos and Areado, Est. Minas Geraes (M. J. de Oliveira.-M.C.Z.). Anápolis, Est. Goyaz (G. Fairchild.-M.C.Z.). Cuyabá, Est. Matto Grosso (J. H. Campbell.-U.S.N.M.; M.C.Z.). Tres Lagôas, Est. Matto Grosso (G. W. Hamlett.-M.C.Z.). Maracajú, Est. Matto Grosso (G. Fairchild.-M.C.Z.). Humaytá, Madeira River, Est. Amazonas (R. Meyer de Schauensee.-Ac.N.S.Phila.). — URUGUAY: Fray Bentos (W. H. Rush.-M.U.Mich.). Nueva Palmira (M.N.H.Chic.). Paysandú (F. Felippone.-M.C.Z.). — ARGENTINA: Entre Ríos (M.C.Z.).

O. F. Müller gave the original (Danish) measurements of his *H. oblonga* as: length, 3 inches 5 lines to 4 inches [= 89.5 to 104.5 mm].; width, 18 to 21 lines [= 39 to 46 mm.]; he had therefore a moderately large specimen. Born's (1780) figure measures (in mm.): length, 91; width, 50; aperture, 47 by 24; and Chemnitz' (1786): length, 100; width, 66; aperture, 58 by 23. de Montfort's figure of *B. roseus* is too distorted for measuring. Mousson's *B. vaporeus* was immature, 31 mm. long and 27 mm. wide. The largest specimen seen by Pilsbry (1895) was 132 mm. long and 76 mm. wide.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
137 mm.	74	64.5	74	32.5	6½	Maracajú
131	83	66.5	78	33.5	6⅓	Belem
127	70	64.5	74	32.5	6¼	Maracajú
121	68	62	68	35	6½	Sorocaba
115.5	57	55	64	25	6⅓	Anápolis
111.5	62	57.5	65	26.5	6⅓	“
110	54.5	49.5	58	24	6⅓	“
110	65.5	57	64	26	6⅓	Patos to Areado
102	67.5	57.5	64	33	6⅓	Santa Ana
99	54	50	57	25.5	6⅓	Port of Spain
98	50	46	53.5	23	6⅕	Igarapé Aniba
97	49	46	53	22	6⅓	Anápolis
93	52	47	53.5	25	6¼	Gurupy R.
83	47.5	41	48.5	20.5	6¼	Anápolis
79	44.5	40	46	19	6	“
74.5	46	41	47.5	20	6	Lagunillas
72.5	41	37	41	18	5½	Entre Ríos
70	39	35	37	17	5½	Surinam (dwarfed)

The average length of typical *oblongus* is therefore about 102 mm. and the average width about 57 mm. Size varies greatly even in the same locality; in the lot from the Gurupy River, for instance, the extremes of length are 130 and 93 mm. for fully adult shells.

Abnormal or deformed shells are by no means rare, particularly in certain localities. Most of them seem to be due to disease, but a few are clearly caused by traumatism. As such shells may readily mislead the beginner, I note some of the most conspicuous cases I have observed.

1. In a lot of otherwise normal *S. oblongus*, of the typical race, from Pará, two are much stunted and heavier than usual, with a distinct umbilical perforation and a peculiarly deformed, duplicate aperture. They consist of the usual 6¼ whorls, yet reach only respectively 53.5 and 68 mm. in length, and 38 and 50 mm. in greatest width (Pl. 2, fig. 5).

2. A shell from Encontrados, Venezuela (M.N.H.Chic. No. 11724) bears a broad shallow furrow below the periphery of the body-whorl,

even affecting somewhat the outer lip. This peculiarity is clearly due to traumatism (Pl. 1, fig. 5).

3. In Barbados deformed specimens are sometimes more frequent than normal ones. Several I have seen are unusually broad and short, irregularly coiled, with distorted sutures (Pl. 18, fig. 4).

4. Several similarly deformed shells occur in a lot from Demerara. One of these has an unusually wide body-whorl and a very broad umbilicus (Pl. 2, fig. 3).

Occasionally in colonies of typical *oblongus*, some specimens apparently reach a very old age and develop a broad accrescent outer lip, similar to that normally formed in subsp. *haemastomus*. In one shell from Puerto Santos, Colombia (U.S.N.M.), the lip measures 12 mm. behind the rim. Dwarfed specimens, with one whorl less than usual, sometimes occur in otherwise normal colonies.

b. S. OBLONGUS ALBUS (Bland and Binney)

Pl. 10, fig. 5; Pl. 22, fig. 2

Bulimus oblongus var. *albus* Bland and W. G. Binney, 1872, Amer. Jl. Conch., **7**, pt. 3, p. 180 (Tobago; description of jaw and radula, not of shell).[1]

Bulimus (*Borus*) *oblongus* var. *albus* W. G. Binney, 1884, Ann. New York Ac. Sci., **3**, (1883), pts. 3–4, p. 115 (jaw and radula).

Bulimus oblongus var. *albolabiata* E. A. Smith, 1894, Proc. Mal. Soc. London, **1**, pt. 3, p. 137 (Tobago).

Strophocheilus (*Borus*) *oblongus* var. *albolabiata* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 197; 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 390,; 1901, Man. of Conch., (2), **14**, p. 123; 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus (*Borus*) *oblongus* var. *tobagoensis* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 30; Pl. 14, fig. 70 (Tobago).

The holotype of *albus*, labelled by Bland himself, is now at the M.C.Z. (No. 90360). That of *albolabiata* should be at the British Museum. I have seen the two cotypes of *tobagoensis* at Ac.N.S.Phila. (No. 66351).

Specimens Examined. TOBAGO (M.C.Z., including Bland and Binney's holotype; M.U.Mich.; Ac.N.S.Phila.). — BRAZIL: without more definite locality, 2 fresh shells (M.U.Mich.). Mouth of Rio Inuixí, south of Santa Isabel, Rio Negro, Est. Amazonas (H. W. Williamson.-M.C.Z.), Pará, 2 apparently fresh shells (Steere.-U.S.N.M.). —

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[1] The name is not invalidated by *Bulinus albus* Sowerby, 1833, a species not now placed in *Strophocheilus*, although it was used by later authors in the combination *Bulimus albus*. The synonymy was first published by Pilsbry.

VENEZUELA: Mérida, 4 specimens (Gabaldon.–U.S.N.M.). Puebla de San Juan, 3,000 ft., 2 specimens (Gabaldon and Sono.–U.S.N.M.).

This form was believed to be peculiar to the island of Tobago, where no other race of the species has been taken thus far. The M.C.Z. recently received a series of 8 specimens, some of them *alive*, obtained on the Rio Negro in Brazil. At the U.S.N.M., 6 fresh specimens from Venezuela are mostly covered with the periostracum. It is therefore not a geographical race, but merely a complete albino, apparently hereditary in certain localities. The shell is usually thinner and lighter than in the other forms of *S. oblongus.*

Smith gave no measurements of *albolabiata,* but stated that it was of the same size as typical *oblongus*. Pilsbry's *tobagoensis* measured: height, 89 mm.; diameter, 52 mm. The measurements of the holotype are given below.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
103.5 mm.	58	52.5	62	26	6⅓	Rio Inuixí
100.5	58.5	50	58	24	6⅓	Tobago
95	53	48	54.5	23	6⅓	" ; holotype
93	54.5	47	51.5	23	6⅓	Rio Inuixí
92.5	55	47	55	23.5	6⅓	Tobago
80.5	40.5	42.5	46.5	21.5	6	Puebla S. Juan

c. S. OBLONGUS ALBESCENS, new name

Bulimus oblongus var. *alba* E. A. Smith, 1894, Proc. Mal. Soc. London, **1**, pt. 3, p. 137 (Bolivia). Not *Bulimus oblongus* var. *albus* Bland and Binney, 1872.

Strophocheilus (*Borus*) *oblongus* var. *alba* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 197; 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 390; 1901, Man. of Conch., (2), **14**, p. 123; 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus oblongus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 297 (in part: specimens from Pampa Ruis, Prov. Laguna, Bolivia). Not of O. F. Müller, 1774.

This is a partial albino, the shell being pure white with rose-pink lip. The type of Smith's *alba,* being part of d'Orbigny's collection, now at the British Museum, came presumably from Pampa Ruis, where d'Orbigny says he obtained specimens with this coloration. I have not seen this form which is known only from Bolivia. Smith gave no measurements, stating only that it was as large as typical *oblongus.*

d. S. OBLONGUS HAEMASTOMUS (Scopoli)

Pl. 6, fig. 2; Pl. 21, fig. 4; Pl. 24, fig. 5

Bulimus haemastomus Scopoli, 1786, Deliciae Faun. Flor. Insubricae, **1**, p. 67; Pl. 25, figs. B1-2 (2 views of type; no locality). Lamarck, 1799, Mém. Soc. Hist. Nat. Paris, p. 75. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 155. Porro, 1846, Coll. Mus. Mediol., Moll. Terr. Fluv., p. 13. Moquin-Tandon, 1855, Rev. Mag. Zool., (2), **7**, p. 241.

Turbo haemastomus Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., **1**, pt. 6, p. 3597 (with a reference to Scopoli's description and figure).

Bulinus haemastoma var. Sowerby, 1838 (October 31), Conchol. Illustr., *Bulinus*, figs. 101 and 103 (left side) of Pt. 146.

Bulimus oblongus Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 34 (in part: thick-lipped var.); Atlas, Pl. 146, figs. 3-4 (Expl. of Plates, p. 20). Not of O. F. Müller, 1774.

Bulimus oblongus var. β Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 21.

Bulimus oblongus var. Pfeiffer, 1853, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. iii; Pl. 22, figs. 1-2.

Bulimus (*Borus*) *oblongus* var. *crassa* Albers, 1850, Die Heliceen, pp. 142 and 144 (description of shell without locality; not the reference to d'Orbigny's specimen from Itatí, Pl. 37, fig. 1). v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191 (Argentina: La Plata); 1876, Novit. Conchol., Abt. I, **5**, pts. 50-51, p. 19. Döring, 1876, Bol. Ac. Nac. Cienc. Exact. Córdoba, **2**, pt. 3, p. 334 (Argentina: Concepción del Uruguay, Entre Ríos); 1877, Periódico Zoológico, **2**, pt. 4, p. 253; 1878, Jahrb. D. Mal. Ges., **5**, p. 135 (Argentina: Prov. Entre Rios); 1884, Bol. Ac. Nac. Cienc. Córdoba, **6**, p. 329 (Argentina: fossil in "subformación pampeana superior" or "piso eolítico"). E. A. Smith, 1894, Proc. Mal. Soc. London, **1**, pt. 3, p. 137 (Paraguay. Brazil: Est. Matto Grosso).

Bulimus oblongus var. *crassus* Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98; 1889, *Op. cit.*, 4th Ed., **2**, p. 214.

Strophocheilus (*Borus*) *oblongus* var. *crassus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 30; Pl. 15, fig. 20 (specimen); 1901, *Op. cit.*, (2), **14**, p. 123; 1902, *Op. cit.*, (2), **14**, Classification, p. v. Wenz, 1923, Fossilium Cat., I, Animalia, Pars 18 (II), p. 359.

Strophocheilus oblongus var. *crassus* H. v. Ihering, 1897, Rev. Mus. Paulista, **2**, p. 334 (Argentina: fossil casts in Paraná deposits, at Paraná, Prov. Entre Ríos). Pilsbry, 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 390. Ameghino, 1902, An. Soc. Cientif. Argentina, **54**, p. 238. H. v. Ihering, 1907, An. Mus. Nac. Buenos Aires, (3), **7**, pp. 461 and 464; 1914, Notas Preliminares Rev. Mus. Paulista, **1**, No. 3, p. 70. Bertoni, 1926, Rev. Soc. Cientif. Paraguay, **2**, pt. 1, (1925), pp. 71 and 73 (Paraguay: Asunción and southwestern section). Jaeckel, 1927, Zoolog. Anzeig., **72**, p. 136 (Brazil: Sa. Rosa, on Uruguay River, Est. Rio Grande do Sul). Felippone and Barattini, 1938, Bol. Servicio Oceanográfico, Montevideo, **1**, pt. 1, p. 56 (common in Uruguay).

? *Bulimus neogaeus* Döring, 1884, Bol. Ac. Nac. Cienc. Córdoba, **6**, p. 329 (*nomen nudum;* listed as occurring in the same strata as var. *crassa*).

Bulimus (*Borus*) *oblongus* var. *crassilabris* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224 (evidently a *lapsus* for *crassa* Albers). Not *Bulimus crassilabris* J. E. Gray, 1834.

Bulimus oblongus var. *crassilabris* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 214.

Scopoli's type of *haemastomus,* originally in the Cabinet of the Duke of Castiglione, is probably lost. The type of *crassa* Albers should be at the Berlin Museum; unfortunately it has never been figured.

E. A. Smith (1894) first recognized that Scopoli had based *haemastomus* on the form of *S. oblongus* which most later authors have called *crassus*; but he did not adopt the earlier name. As some authors have used the name *haemastomus* for typical *oblongus,* I have listed under the latter all references fairly recognizable as such.

One finds occasionally, throughout the range of typical *oblongus,* specimens which in old age have acquired a thicker texture and a very broad rim. Such specimens, however, predominate in southern Brazil, Uruguay and the adjoining areas of northern Argentina, and are especially common in Matto Grosso. They seem to be to some extent characteristic of this general region. Although the locality of Scopoli's type is not known, I propose to restrict the name *haemastomus* to the heavy, broad-rimmed and on the average smaller specimens of that southern geographical area only. Somewhat similar, but usually lighter specimens, occasionally found elsewhere in colonies of typical *oblongus,* should not be regarded as belonging to subsp. *haemastomus.* It should also be noted that typical *oblongus* is likewise found in the area peculiar to *haemastomus,* sometimes even in the same locality. Most probably, however, the two forms live under different ecological conditions, *haemastomus* occurring mainly or exclusively in the drier environment of the open grasslands ("campos"), while typical *oblongus* prefers the moister conditions of gardens and the vicinity of human habitations. In many cases typical *oblongus* is merely a follower of human culture, in most cases originally imported by man.

I have seen an interesting sinistral specimen of *S. oblongus haemastomus* at A.M.N.H. (No. 53334), unfortunately without trustworthy locality. The indication "Peru" on the label I regard as erroneous. I refer it to subsp. *haemastomus* owing to the heavy texture, the relatively small size, and the accrescent outer lip. Length, 71 mm.; width in front view, 45 mm.; width in profile, 38 mm.; aperture, 43 by 20 mm.; of 5⅔ whorls. It is the second known case of sinistrosity in *Strophocheilus*, where this condition appears to be excessively rare in view of the many specimens studied by myself and previous authors.

Specimens Examined. URUGUAY: Dept. Soriano (F. Felippone.–U.S.N.M.). Costas de Maldonado (F. Felippone.–U.S.N.M.). Mercedes, Dept. Soriano (M.C.Z.). Fray Bentos (Ac.N.S.Phila.; M.U.Mich.). — BRAZIL: Santa Maria, Est. Rio Grande do Sul (T. White and L. I. Price.–M.C.Z.). Imbituba, Est. Santa Catharina (G. de Campos.–M.C.Z.). Maracajú, Est. Matto Grosso (G. B. Fairchild.–M.C.Z.). Tres Lagôas, Est. Matto Grosso (G. W. Hamlett.–M.C.Z.). Corumbá, Est. Matto Grosso (H. H. Smith.–U.S.N.M.) Anápolis, Est. Goyaz (G. B. Fairchild.–M.C.Z.). — ARGENTINA: Prov. Entre Ríos (M.U.Mich.). Las Palmas, Chaco (A. Wetmore.–U.S.N.M.). Santiago del Estero (M.N.H.Chic.).

Scopoli's figure of *haemastomus*, said to be natural size, measures (in mm.): length, 98; width in front view, 45; aperture, 50 by 19. The figure appears to have been distorted by the draftsman, which may explain the exaggerated sutures. The original measurements given by Albers for his *crassa* were (in mm.): length, 79; width, 39; aperture, 32 by 19; thickness of outer lip, 19 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
111 mm.	62	56	63	26	6½	Tres Lagôas
84.5	48	39	50	19.5	6⅓	Maracajú
82.5	50	46	48	22	6⅓	Mercedes
82	49	42.5	48	20	6½	Santa Maria
77.5	48	42.5	46	21	6½	" "
77.5	47.5	42	47.5	21	6⅓	Maracajú
71.5	39.5	34	41.5	17	6⅓	Paysandú
69	39	33.5	38	18	6½	"
69	43	37.5	42	19	6½	Santa Maria
67.5	41.5	37.5	41	19	6⅓	Buena Vista
66.5	36.5	33.5	35	16.5	6	Entre Ríos
63	35.5	32.5	37	17	5½	" "

The average length of this race is about 76 mm. and the average greatest width about 44 mm.

An unusually large and slender *haemastomus*, obtained at Corumbá by H. H. Smith, is not included in the table of measurements. It is 120 mm. long, 61.5 mm. in greatest width, the aperture 59 by 25 mm., of nearly 7 whorls. An extensive peripheral area of the body-whorl is worn completely smooth. The collector evidently picked it up in the town. He noted that it had been used for smoothing corn-husks which serve locally as cigarette wrappers. The peristome of this specimen is very thick, also at the parietal wall, and the accrescent outer lip is 10 mm. wide. A century ago, d'Orbigny (1837) reported a similar use for the shell of his *B. kremnoicus* (= *S. maximus*) in Bolivia.

While typical *S. oblongus* occasionally produces a widened outer lip in old age, these accretions are a more regular occurrence in the subsp. *haemastomus*. They are also more noticeable because of the relatively smaller size of this race. The widest lips I have seen, 18 mm. and 15 mm. behind the rim, were in shells from "Brazil"; the lip is 13 mm. wide in a shell from Las Palmas in the Argentinian Chaco. Férussac's fig. 3 (in Deshayes, 1851) shows a rim 16 to 17 mm. wide, and Albers originally gave 19 mm. for the width of the outer lip of his *crassa*. When the accrescence is very pronounced, the columella and parietal wall are also much thickened, as a rule.

Original description of Scopoli's *haemastomus*: "Testa elliptica, solida, glabra; anfractibus senis, striatis; apertura marginata. Testa elliptica, gibba, glaberrima, alba, imperforata. At dorsum anfractus primi rufescens. Hujus longitudino triuncialis, nec raro etiam major. Anfractus sex, laeves ventricosi, contigui: plerisque transversim striatis. Apertura antice rotundata, postice convergens, intus fuscescens, marginata. Hujus labia tumida, rubra: interiore planiore, et obsoleto sinu ad columellam notato."

e. S. OBLONGUS PERELONGATUS, new subspecies

Pl. 22, fig. 3

Shell unusually large and slender. Summit of spire obtusely pointed as in typical *oblongus*, but the penultimate whorl relatively broader, which gives the shell a peculiar outline. Nepionic sculpture as in typical *oblongus*. Aperture shaped as in the typical form, but relatively shorter due to the lengthening of the spire; outer lip moderately thick, not appreciably reflexed. Color as in typical *oblongus*, the columella, parietal wall and outer lip roseate.

Specimen Examined. COLOMBIA: Río Guamal, San Martín, Intendencia del Meta, 550 m., holotype (L. Richter.–M.C.Z. No. 145202).

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
135 mm.	66	60.5	70	32.5	6½	Holotype

The shape of this shell is so unusual that one might be tempted to regard it as a different species. It is rather similar in outline to *S. maximus vestitus*; but the sculpture of the nepionic whorls is that of *S. oblongus*. The granulation on the following whorls is mostly worn away, only traces of it remaining here and there.

A young shell, 32 mm. long, found with the type, presumably belongs to the same race.

f. S. OBLONGUS ELONGATUS, new subspecies

Pl. 1, fig. 4; Pl. 2, fig. 4

Much narrower, with relatively higher spire and smaller aperture than most subspecies of *oblongus*, although with the characteristic nepionic sculpture and bluntly pointed summit of the species. Medium-sized, thick and heavy in life; outer lip accrescent in old age (in one paratype 11 mm. wide behind the rim). Surface rather roughly, vertically striate and in the four fresh specimens seen mostly densely granulose (more so than in typical *oblongus*); granules much less distinct and more vertically lengthened on body-whorl. Color of typical *oblongus*; outer lip, columella and parietal wall a deep pink.

Specimens Examined. URUGUAY: Nueva Palmira, Colonia (A. Carceles.–M.C.Z., holotype No. 76538, and 2 paratypes No. 151446; A. Teisseire.–U.S.N.M., 1 paratype No. 381573). Paysandú, 1 paratype (F. Felippone. U.S.N.M. No. 271473). Soriano, 1 paratype (F. Felippone.–M.U.Mich., No. 67785). — PARAGUAY: Three worn paratypes, without definite locality (D. Weese.–M.C.Z. No. 175162). Asunción, 1 paratype (A. de W. Bertoni.–M.C.Z. No. 179234). — A paratype at U.S.N.M. (No. 307498), from the Redfield Collection, is labelled "Colombian Andes"; but this locality does not appear to be trustworthy.

The specimens from Nueva Palmira were received under the name "*Borus oblongus* var. *crassus*." They are, however, much more slender than true subsp. *haemastomus* (= *crassus*).

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
92 mm.	47	41.5	49	22.5	6	Asunción
84	45	38	46.5	20	6	Paysandú
83	43	39	43.5	17.5	6	? Colombia
80.5	40	36	43	17.5	6	Soriano
80	41	37.5	43.5	17	6	Nueva Palmira, holotype
79	42	37	40	18	6	Paraguay
78.5	41.5	37.5	41	16.5	6	Nueva Palmira
77.5	44.5	40	42	19	5¾	Nueva Palmira
77.5	40.5	35.5	41.5	17.5	5¾	Paraguay
73.5	39.5	33	39	17	5¾	"

Except where noted, the foregoing measurements are based on paratypes. The thickest rim of the outer lip measured is 5 mm. wide. The average length is nearly 80 mm. and the average width about 41 mm.

g. S. OBLONGUS CONICUS, new subspecies

Pl. 6, fig. 1; Pl. 19, fig. 2; Pl. 23, figs. 1, 3

Medium-sized, with upper part of spire more conical and narrower and with relatively smaller aperture than in typical *oblongus*; greatest width of body-whorl, in front view, much below mid-length of shell, at about lower third. Shell solid and heavy, with the sculpture of typical *oblongus*. Umbilical slit open or narrow. Rim of outer lip moderately accrescent (4 mm. wide in holotype, 2 mm. in one paratype and 5 mm. in another). Color of shell and peristome as in typical *oblongus*.

Specimens Examined. BRAZIL: State of Maranhão (*ex* Moricand; received by J. G. Anthony from Cuming as *S. capillaceus*.–M.C.Z., holotype No. 74405 and paratype No. 151447). Bahia, without more definite locality, five paratypes from the Haines Coll. (A.M.N.H. No. 41790). Varzea do Sal, Est. Bahia, one paratype (J. C. Branner.–U.S.N.M. No. 225964). "Certão de Bahia," Est. Bahia, one paratype (U.S.N.M. No. 104898). Near Guygos, Est. Bahia,[1] three paratypes, "in forested country with underlying limestone" (O. C. Farrington.–M.N.H.Chic. No. 11692). East of Jacobina, Est. Bahia, one paratype (Thayer Exped.–M.C.Z. No. 74404). Campo Formoso, Est. Bahia, three paratypes (M. J. de Oliveira. M.C.Z. No. 137133). Amparo, Municipio de Cipó, Est. Bahia, one paratype (M. J. de Oliveira.–M.C.Z. No. 137143).

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[1] I have been unable to find this locality on a map or to obtain any information about it. Dr. F. Haas suggests that it may have been a misspelling of "Grungogi," a place south of São Salvador, in 15° S.

Measurements of Adult Shells
(paratypes except for the one holotype)

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
103 mm.	55	48	57.5	24	6½	Campo Formoso
98.5	51	47.5	51.5	22	6½	Guygos
95.5	55	47	54.5	23	6½	Campo Formoso
85	49	44	47.5	20	6½	Certão de Bahia
83	46	41	44.5	19	6⅓	Varzea do Sal
81	48	41.5	43	19	6⅓	Maranhão
76	41.5	36	40	18	6¼	Maranhão, holotype
73.5	41	35	41.5	19	6¼	Bahia
68.5	40	33.5	39.5	17	6	"

Branner noted that the region of Bahia where he obtained a paratype was one of limestone rock. He collected with it two broken tops of the same race, which show the wall of the early whorls unusually thickened inside by additional deposits of lime, up to 9 mm. thick (Pl. 6, fig. 1). His paratype, however, was not subfossil, but very fresh, with a bright roseate peristome.

h. S. OBLONGUS LORENTZIANUS (Döring)

Pl. 27, fig. 5

Bulimus (*Borus*) *lorentzianus* Döring, 1876, Bol. Ac. Nac. Cienc. Exact. Córdoba, **2**, pt. 3, p. 336 (Argentina: Sierras of Tucumán, Prov. Salta and Jujuy; with var. *major* and var. *minor*); 1877, Periódico Zoológico, **2**, pt. 4, p. 255.

Strophocheilus (*Borus*) *lorentzianus* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 197; 1901, *Op. cit.*, (2), **14**, p. 125.

Borus oblongus var. *lorentzianus* Frenguelli, 1924, Bol. Ac. Nac. Cienc. Córdoba, **26**, pts. 2-4, p. 409, figs. 3, 4, 8, and 9 (dead specimens from old Indian burying grounds on the Río San Roque, Sierra Chica de Córdoba, Dept. Punilla, Argentina).

Strophocheilus lorentzianus Frenguelli, 1937, Obra del Cincuentenario, Mus. La Plata, **2**, p. 236 (Argentina: Sa. María Valley, Prov. Salta).

Borus (or *Strophocheilus*) *lorentzianus* María I. H. Scott, 1939, Rev. Mus. La Plata, (N.S.), Secc. Zool., **1**, No. 7, pp. 217-278 (jaw, radula, anatomy. Argentina: Mar Chiquita, Prov. Córdoba; Vinalito, Sierra Sa. Bárbara, Prov. Jujuy); figs. of shell on p. 220, and figs. 1-24 and 25A.

Bulimus (*Borus*) *lorenzianus* Döring, 1878, Jahrb. D. Mal. Ges., **5**, p. 135. Misspelling of *lorentzianus*.

Strophocheilus (*Borus*) *lorenzianus* Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. v.

Borus lorentzianus Cockerell, 1926, The Nautilus, **39**, p. 77; Pl. 4, fig. 4 (Argentina: Sunchal, Santa Bárbara Hills, Prov. Jujuy).

Borus oblongus var. *minor* Ancey, 1897, Boll. Mus. Zool. Anat. Comp. Torino, **12**, No. 309, p. 12 (Argentina: San Lorenzo, Prov. Jujuy. Described as new, without reference to Döring's var. *minor*). Not *Bulimus rosaceus* var. *minor* d'Orbigny, 1837).

Döring's types of *B. lorentzianus* (var. *major* and var. *minor*) may be at the Zoological Museum of the University of Córdoba, Argentina. Ancey based his *B. oblongus* var. *minor* on two specimens at the Zoological Museum of the University of Turin.

Specimens Examined. ARGENTINA: Sunchal, Prov. Jujuy (T.D.A. Cockerell.–Ac.N.S.Phila.). Tucumán (F. Schade.–M.C.Z.; U.S.N.M.). Jujuy, Prov. Jujuy (W. J. Eyerdam.–M.C.Z.). Cadillal, Prov. Tucumán (A. Carcelles.–M.C.Z.). Sáenz Peña Chaco (Max Birabén.–M.C.Z.). Santiago del Estero (U.S.N.M.). — BOLIVIA: Loma de Ipaguasú, 15 miles N.E. of Yacuiva (Kirk.–U.S.N.M.). Yacuiva, Dept. Tarija (E. W. Shaw.–U.S.N.M.). 40 miles N.E. of Villa Montes, Chaco (E. W. Shaw.–U.S.N.M.).

S. o. lorentzianus is perhaps the best defined of the several forms here subordinated under *S. oblongus*. It fully deserves at least subspecific rank. The following are its main characteristics: (1) The adult shell averages about one whorl less than typical *S. oblongus* of the same size. (2) The summit is broader and more obtuse than usual, approaching that of *S. intertextus* in shape, but with the nepionic riblets of *oblongus*. (3) The body-whorl is rather coarsely rib-striate, particularly in the upper half. (4) The whorls are somewhat more convex than usual, particularly the body-whorl, which is often very obese; but this feature varies and is most pronounced in the larger shells. The color is uniform and even in very fresh shells, collected alive, there is no trace of the paler subsutural band which is often, though not always, present in typical *oblongus*. The peristome is bright vinaceous-pink and the outer lip is not or moderately accrescent (up to 8 mm. wide behind the rim). The shell is rather light for its size.

Döring's measurements of *B. lorentzianus* were (in mm.) for var. *major*: "Long. 95–100; lat. 64–66; ap. c. perist. 57–58 longa, 42–43 lata;" and for var. *minor*: "Long. 75; lat. 45; ap. c. perist. 42 longa, 33 lata. Ancey's *B. oblongus* var. *minor* was defined merely by the measurements: length, 75 to 80 mm.; width, 45 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
98 mm.	62	53.5	59	27.5	5½	Jujuy
92.5	58	52	55	26	5½	Tucumán
90	56	50	54	25	5½	Cadillal
89	58.5	50	54.5	26	5⅓	"
83	52.5	46	48.5	24	5⅓	Tucumán
78	47.5	42.5	49.5	23	5½	S. del Estero
75	47	40	44	21	5¼	Jujuy
72.5	45.5	37.5	43	21	5	Sunchal

Original description (Spanish text translated) of *B. lorentzianus*: "T. subimperforata, ovata, solidula, crassiuscula, vix nitens, albido-fulva, rugoso-striata, necnon ad suturam zonata, apice obtusiuscula; anfractus 5½–6 convexiusculi, summa regulariter et confertim regulariter costulato-striati, ultimus ventrosus, striato-rugosus, 5/9 longitudinis subaequans; apertura ovato-oblonga, intus nitide rufo-pallida; peristoma incrassatum, breviter expansum, reflexiusculum, intense roseo-purpureum, marginibus callo diffuso roseo-purpureo, nitido, junctis; columellari dilatato, appresso. *a.* var. *major,* crassa. b. var. *minor,* ovato-oblonga, tenuis, intense fulva. — Differt a *B. ovatus*: peristomate reflexiusculo, necnon sutura albidozonata; a *B. bronni* Pfe.: sculptura, callo purpureo, necnon columella plicata; a *B. capillaceus* Pfe.: sculptura, necnon sutura albido marginata. This species is somewhat similar to *B. oblongus* M., but differs markedly in the shape of the outer lip, which, although produced outwardly, is not reflexed nor appressed against the body whorl; the sculpture is similar to that of the larger variety of *B. oblongus*, from Venezuela, a little more coarse; the white spiral stripe, near the suture, is entirely absent and the color of the outer lip is much more intense."

i. S. OBLONGUS MUSCULUS, new subspecies

Pl. 12, fig. 6; Pl. 20, fig. 1; Pl. 31, fig. 4

? *Bulimus oblongus* d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 297 (text in part: variety of 46 mm., thin-lipped, from Corrientes, 28°S., Argentina). v. Martens, 1894, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 164 (Paraguay: shells 65 and 75 mm. long).

Bulinus haemastoma var. Sowerby, 1838 (October 31), Conchol. Illustr., *Bulinus*, fig. 103 (right side) of Pt. 146.

? *Bulimus oblongus* var. δ Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 21 ("minor: long. 54, diam. 34 mill. Ap. intus 33 mill. longa, 18 lata;" no locality).

Average size smaller than most other races of *oblongus*, of only 5 to 5¾ whorls, in general shape similar to *S. intertextus*, the spire being relatively wider and the summit more broadly rounded; but the shell is thin and light, and the rim of the outer lip is little or not accrescent in old age. The nepionic riblets are as in *oblongus*, although, due to the small size, they appear to be somewhat more crowded. The first nepionic whorl is not as depressed as in *intertextus*. In many respects *musculus* is a diminutive *lorentzianus*, but the rib-striae of the body-whorl are much weaker. These two races seem to intergrade in certain sections of northern Argentina, as shown by the small lot from Calilegua, Jujuy. Possibly *lorentzianus* is a form of mountainous or wooded areas, while *musculus* occurs in flatter and more open country.

Specimens Examined. PARAGUAY: Villarrica, holotype (F. Schade.–M.C.Z. No. 62471). Tujuty, Villarrica, 4 paratypes (M.C.Z. No. 75748; D.Z.S.P.). Chaco, 2 paratypes (F. Felippone.–U.S.N.M. No. 362887; M.N.H.Chic., No. 25915). Asunción, 6 paratypes (A. Carcelles.–M.C.Z. No. 76537). 80 Kilom. W. of Puerto Pinasco, 2 paratypes (A. Wetmore.–U.S.N.M. No. 341249). San Lorenzo, 4 paratypes (W. A. Archer.–U.S.N.M. No. 423996). — ARGENTINA: Entre Ríos, 1 paratype (M.C.Z. No. 124838). Tartagal, Prov. Salta, 1 paratype (Max Birabén.–M.C.Z. No. 179791). Calilegua, Prov. Jujuy, 4 paratypes (W. H. Osgood.–M.N.H.Chic. No. 11695). — Two paratypes, labelled "Bolivia," possibly by error (A.M.N.H. No. 41796).

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
84.5 mm.	49	42	47	21	5¾	San Lorenzo
80.5	47.5	40.5	45.5	21	5⅔	Asunción
79	44	38	45	19.5	5⅔	"
75	45	39.5	45.5	20.5	5½	"
74.5	45	40	44	20	5½	San Lorenzo
72.5	41	37	41	18	5	Villarrica, holotype
70	41	35	41.5	19	5½	Pto Pinasco
69	41	35.5	42	19	5¼	San Lorenzo
68	45	43	44	20	5	Chaco, Paraguay
67	40.5	34	41	18	5¼	Pto Pinasco
67	40.5	34	40	19	5¼	Calilegua
63.5	37	33.5	38	17	5⅓	Tujuty
63	36	32	34.5	15.5	5⅓	Entre Ríos
61	36.5	32	37.5	16.5	5⅕	Asunción
57	32.5	27	32.5	15	5¼	Tujuty

57.5	34	29.5	34	16.5	5¼	Asunción
55.5	35.5	32	34	16.5	5¼	Tujuty
52	32.5	28	31.5	15	5	“

Except where mentioned, the measurements are based on paratypes. The average length of *musculus* is about 67 mm. and the average width 40 mm. Sowerby's figure which I refer to *musculus* is 64 mm. long, 40 mm. wide, the aperture 38 by 17.5 mm.

The paratype from the Paraguayan Chaco at M.N.H.Chic. (included in the table of measurements) is unusually wide and somewhat deformed, having more the shape of a small *lorentzianus*; but it lacks the strong rib-striae of the body-whorl of that race.

Strophocheilus (Megalobulimus) intertextus Pilsbry

Pl. 18, fig. 3

Strophocheilus (*Borus*) *capillaceus* var. *intertextus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 32; Pl. 17, figs. 30-31 (Brazil: Corumbá, Est. Matto Grosso); 1901, *Op. cit.*, (2), **14**, p. 123 (Uruguay: Fray Bentos); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus (*Borus*) *intertextus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 5.

Strophocheilus intertextus H. v. Ihering, 1915, Commissão Linhas Telegr. Matto Grosso Amazonas, Annexo 5, Molluscos, p. 8 (Brazil: Porto Espiridião and Corumbá, Estrada de Ladário, Est. Matto Grosso). Pilsbry, 1933, Proc. Ac. Nat. Sci. Philadelphia, **85**, p. 69 (Brazil: Sa. Rosa near Descalvados, Est. Matto Grosso). Rehn, 1934, Scientific Monthly, **39**, p. 19.

Bulimus oblongus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 297 (in part: specimens from Itatí on Paraná River, Argentina; and thick-lipped specimens from Prov. Chiquitos, Bolivia); Pl. 37 (36 of Expl. of Plates, p. 695), figs. 1-3 (animal; egg). H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146 (in part); Pl. 75, fig. 5 only (animal, after d'Orbigny, 1837). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 26 (? in part: variety from Bolivia). Mrs. M. E. Gray, 1859, Figures Moll. Animals, **1**, Pl. 74*, fig. 4 (after d'Orbigny, 1837); *Op. cit.*, **4**, p. 15. Not of O. F. Müller, 1774.

Bulimus oblongus var. γ Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 21 (Argentina).

? *Streptocheilus capillaceus intertextus* de Souza Lopes, 1940, Revista de Entomologia, **11**, p. 940 (Paraguay: Sa. Trinidad; with saprophagous Diptera. The identification of the snail appears doubtful).

The type of *intertextus* is at Ac.N.S.Phila., where I have seen it. This species is very similar in the heavy texture of the shell and in the broadly accrescent rim of the outer lip to small examples of *S. oblongus* subsp. *haemastomus*. As a result, the two have been frequently confused. Some of the references which I have listed tentatively under *S. oblongus haemastomus* (as *oblongus* var. *crassa*) were possibly based on specimens of *S. intertextus*; but it is impossible to decide this without seeing the shells. In the case of d'Orbigny's figure of the animal (1837), the broadly rounded summit of the spire seems to make the identification as *intertextus* fairly certain. This figure was merely copied by H. and A. Adams (1855) and by Mrs. M. E. Gray (1859). Hupé's variety from Bolivia is doubtfully referred here.

The description of Pfeiffer's (1848) variety γ is clearly *intertextus*: "Testa crassa, alba, apice obtusiuscula, rugosa, anfractu penultimo subgibbo, apertura parvula, columella et peristomate roseis. — Long. 76, diam. 43 mill. Ap. intus 36 mill. longa, 19 lata."

Specimens Examined. BRAZIL: Corumbá, Est. Matto Grosso, holotype (Ac.N.S.Phila. No. 69158), and one adult with as yet thin outer lip, said to have been part of the type lot (U.S.N.M. No. 337630). Fazenda San Juan, Cuyabá River, Est. Matto Grosso (C. H. Cherrie.-A.M.N.H.). Fortaleza Principe de Beira, 240 miles up the Guaporé River, Est. Matto Grosso (Fred Baker.-M.C.Z.).—BOLIVIA: Buena Vista, Prov. Sara, Dept. Santa Cruz (J. Steinbach.- M.C.Z.; M.U.Mich.; Ac.N.S.Phila.). — One specimen at D.Z.S.P., sent by Dr. Oliverio M. de Oliveira Pinto, is labelled "Paraguay," but the locality appears questionable.

S. intertextus differs from *S. oblongus*, in two main features. (1) The nepionic riblets are narrower and sharper, more regular and more crowded. The intervals are deep and narrow, usually as wide as a riblet; at mid-height of the third whorl they measure less than half a mm. (2) The spire is relatively short and broad, with the summit rounded off and the first nepionic whorl flattened, so that it is not seen in a front view of the shell. The adult shell has from 5 to 5½ whorls. It is often very thick and heavy and the accrescent outer lip may be up to 8 mm. wide behind the rim in old age. The entire peristome is bright pink.

The broad, flattened summit and fine, crowded nepionic riblets usually separate *intertextus* from most races of *oblongus*. Some difficulty may be experienced with the dwarf race *S. oblongus musculus*, particularly if the nepionic sculpture is worn. This race often has the summit almost as broadly rounded as *intertextus*. The thin texture of *musculus* is of assistance in such cases. The adult shell of *S. intertextus* has about one whorl less than most forms of *S. oblongus*, with the exception of subsp. *lorentzianus* and subsp. *musculus*. Small specimens of subsp. *haemastomus* with worn summit may be separated by the more pointed apex and usually also by the larger number of whorls.

S. intertextus is in fact much more closely related to *S. capillaceus*, so much so that I am far from convinced that these two are specifically distinct. Both have the same broadly rounded summit and practically the same nepionic sculpture. *S. capillaceus* is, however, always light, regularly elliptical in outline, and with a more oblique aperture. Nevertheless I am inclined to regard *intertextus* as a subspecies of *capillaceus*, adapted to the drier, open campos or grassland environment; typical *capillaceus* inhabiting the densely shaded and humid forests of the Andean slopes of Peru.

Pilsbry gave the following measurements for his *intertextus* (in mm.): length, 64; diameter, 41; length of aperture, 35. His figure is, however, slightly larger and agrees better with the type, as shown by the measurements given below.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
76.5 mm.	45	37	43	20.5	5¼	Buena Vista
75.5	46	40	42.5	21	5¼	No locality
69	39	35.5	39	18	5⅓	Principe de Beira
68.5	38.5	35	40	19	5⅕	Buena Vista
66.5	42	34.5	38	18.5	5¼	Corumbá, holotype
65.5	41	34	36.5	18	5¼	Principe de Beira
62	37	32	37	18	5¼	Fazenda San Juan
55.5	32	29.5	33	16.5	5⅙	" " "

STROPHOCHEILUS (MEGALOBULIMUS) LICHTENSTEINI (Albers)

a. Typical LICHTENSTEINI

Pl. 1, fig. 1; Pl. 10, fig. 4

Bulimus lichtensteini Albers, 1854, Malak. Blätt., **1**, p. 216 ("in Columbia ad flumen Maranhon"; on p. 215, footnote, the locality is given as the Peruvian-Colombian border). Pfeiffer, 1855, Novit. Conchol., Abt. I, **1**, pt. 3, p. 33; Pl. 9, figs. 1–2 (type); 1859, Monogr. Helic. Viv., **4**, p. 336; 1868, *Op. cit.*, 6, p. 11. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Lubomirski, 1880 (April), Proc. Zool. Soc. London, for 1879, p. 721 (Peru: Guajángo). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 213.

Bulimus (*Borus*) *lichtensteini* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 20. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *lichtensteini* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 32; Pl. 11, figs. 55–56 (after Pfeiffer) (misprinted *lichensteini* in Expl. of Plates, p. 202); 1902, *Op. Cit.*, (2), **14**, Classification, p. v.

The type of *lichtensteini* passed with Albers' collection to the Berlin Museum. The original lot contained at least two specimens, the measurements of which are given by v. Martens (1876).

Specimens Examined. PERU: Bellavista on the Upper Marañon, Dept. Cajamarca, 22 adult and 4 young specimens (G. K. Noble.–M.C.Z.; M.N.H.Chic.; M.U.Mich.). — The only definite locality known thus far was Guajángo, which is evidently close to Bellavista.[1] The type no doubt came from the same district.

Shell medium-sized (72 to 87 mm. long), light, somewhat translucent, elongate-ovate in outline, widest at lowest third; spire more tapering than base; summit bluntly pointed, all nepionic whorls well raised above one another. Whorls more bulging than in *S. capillaceus*, with deeper sutures; body-whorl very convex, not saccate at base, occupying about five-sixths of total length, its suture seen from the back slightly more slanting than the preceding one. First and part of second nepionic whorls smooth; then appear narrow, strong, close-set, slightly oblique riblets, about as wide as their intervals below the suture and only slightly spreading farther down, extending from suture to suture; riblets gradually weaker on penultimate whorl and on body-whorl only visible as irregular folds immediately below the suture. Granulose microsculpture almost entirely lacking; youngest shell seen (47 mm. long, of 4½ whorls) with microscopic spiral threads in some of the intervals between the riblets on the second and part of the third whorls and minute granulation on the remainder of the nepionic shell; no granulation can be detected on penultimate and body-whorl, which, however, often are superficially malleate. Aperture slightly oblique, at first broadly semi-elliptical, becoming more ovate in old age. Upon becoming adult, the shell produces a simple peristome, with a thin parietal callus, a slightly thickened and scarcely expanded outer lip, and a thin, broadly curved columella, which has a very narrow, barely twisted fold above and passes by a broad basal curve into the outer lip; with advancing age the shell deposits accretions over the entire rim, eventually giving rise to a protruding, detached crest at the parietal wall and columella, and to a thickened flat zone at the outer lip; this zone in one shell (Pl. 1, fig. 1) 12 mm. wide. This peculiarity was described by Albers as follows: "perist. breviter expansum, late incrassatum, marginibus callo crassiusculo, nitido junctis, columellari adnato." Parietal wall never with an upper swelling, even in old age. Umbilical slit very narrow or completely closed. Periostracum uniformly dull, pale yellowish-brown; no light subsutural band. Parietal wall, columella and outer lip white.

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[1] In a paper on the birds of Peru by Taczanowski (1879 (August), Proc. Zool. Soc. London, for 1879, p. 220) Guajángo is described as a village of 10 huts in the valley of the Marañon, near the latitude of Tambillo (6° S.), in Dept. Cajamarca, Prov. Jaen, District Choros. The altitude is given by one observer as 800 ft., by another as 1,500 ft.

Pfeiffer's figure of the type in front view has a bulge at the right side of the penultimate whorl, which is not present in any of my large series. I regard it as an abnormality, probably due to traumatism, the figure showing traces of injury at the beginning of the body-whorl.

S. lichtensteini has the same type of nepionic riblets as *S. capillaceus*. It differs, however, greatly in size and shape, particularly in the more pointed summit, narrower spire, deeper sutures, wider aperture (with the peristome white, not pink), and the characteristic accrescent peristome of older shells.

Albers' original measurements of *lichtensteini* were (in mm.): length, 75; width, 40; aperture, 40 by 24. Pfeiffer's figure of the type is 73 mm. long, 45 mm. wide in front view, aperture 39 by 22 mm., agreeing closely with v. Martens' (1876) measurements of one of the cotypes. The other cotype seen by v. Martens was 70 mm. long, 43 mm. wide, aperture 41 by 24 mm.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
86.5 mm.	52.5	45	49	27.5	5¾	Bellavista
84.5	47.5	42	48	26	5¾	"
82	50	42.5	46	26	5¾	"
79	48.5	41.5	47	25	5½	"
77	44	38.5	43	22.5	5½	"
74	45	40	44	25	5½	"
72	45	39.5	43	24	5½	"

b. S. LICHTENSTEINI SEMIMALLEATUS Fulton

Pl. 3, fig. 1; Pl. 4, fig. 2

Strophocheilus (Borus) semimalleatus Fulton, 1905, Jl. of Malacology, 12, p. 24; Pl. 6, fig. 2 (Peru).

The present location of the figured type of *semimalleatus* is not known to me. It is not at the British Museum (M. Connolly, *in litt.*, 1946).

Specimens Examined. PERU: Four without more definite locality (M.C.Z.; Ac.N.S.Phila. No. 107823, purchased from Sowerby and Fulton in 1912 and possibly a cotype, although it is not marked as such). Chanchamayo (M.C.Z.). Jaén, Dept. Cajamarca, 900 m., 6 adult and 2 young shells, one adult alive (W. Weyrauch.–M.C.Z.).

This form differs from typical *lichtensteini* in being relatively much broader, with the body-whorl more swollen and the aperture somewhat wider in proportion to its length. The sculpture is the same as in the typical form. One specimen in the Jaén lot is more slender than the others and clearly transitional to typical *lichtensteini*. In all specimens seen, the outer lip, although relatively little thickened, is accrescent behind the rim (5.5 mm. wide in one shell, 8.5 mm. in another). The peristome is white.

Fulton gave the measurements as: "Maj. diam. 51, alt. 90 mm." His figure is, however, 90 mm. long, 57 mm. in greatest width, with the aperture 51 by 32 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Width	Whorls	
97 mm.	58	49	56.5	29	5⅓	Jaén
96	61	50	60	32	5⅕	Peru
92.5	58	47.5	55.5	30	5	"
87	54	46	53	28	5	Jaén
86	55	48	57	30.5	5	Chanchamayo
85.5	56.5	45	52	30	5	Peru
85	47	41	49	25	5	Jaén

STROPHOCHEILUS (MEGALOBULIMUS) MAXIMUS (Sowerby)

S. maximus and its nearest relatives are difficult to deal with, owing to the great variation in size and shape. At present I regard *S. popelairianus* as a distinct species, but I believe that eventually it will be made a subspecies of *maximus*. On the other hand, I subordinate *huascari* subspecifically to *maximus*, because of the occurrence of intermediate shells which must be placed arbitrarily. Nevertheless, some populations are very uniformly of the *huascari* type. d'Orbigny's *kremnoicus* appears to have been a mixture of typical *maximus* and of a more slender shell, which Pilsbry later described as *vestitus*. This name I have provisionally given subspecific status, although it covers probably individual variants only and should then be synonymized with typical *maximus*. All these forms have the same sculpture, as described below for typical *maximus*.

a. typical MAXIMUS

Pl. 3, fig. 5; Pl. 21, fig. 5

Cochlogena maxima Sowerby, 1825, Cat. Coll. Earl Tankerville, p. 39 (name only), and Appendix, p. vii (description; no locality).

Bulimus maxima J. E. Gray, 1825, Ann. of Philos., (N.S.), **9**, p. 413.

Bulimus (*Bulimus*) *maximus* Beck, 1837, Index Moll., pt. 1, p. 53.

Bulinus maximus Sowerby, 1838 (before October 31), Conchol. Illustr., *Bulinus*, fig. 63 of Pt. 138 (type).

Bulimus maximus Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 157. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 51, fig. 337. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 19; 1853, *Op. cit.*, **3**, p. 303. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Pfeiffer, 1858, Malak. Blätt., **5**, p. 161; 1859, *Op. cit.*, **6**, p. 36; 1859, Monogr. Helic. Viv., **4**, p. 365; 1868, *Op. cit.*, **6**, p. 10. Haines, 1868, Cat. Terr. Shells Coll., p. 51. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 12; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 214.

Bulimus (*Borus*) *maximus* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 4. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 223. v. Martens, 1885, Conchol. Mittheil., **2**, pts. 3–4, p. 157 (Brazil: Rio Tocantins near Baião, Est. Pará).

Borus maximus Semper and Simroth, 1894, Reisen Arch. Philippinen, pt. 2, vol. **3**, Ergänzungsheft 2, pp. 52, 53, and 63; Pl. F, figs. 5 and 9 (anatomy).

Strophocheilus (*Borus*) *maximus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 15; Pl. 4, fig. 5 (after Reeve); 1901, *Op. cit.*, (2), **14**, p. 120; 1902, *Op. cit.*, (2), **14**, Classification, p. iv. F. Baker, 1914, Proc. Ac. Nat. Sci. Philadelphia, (1913), p. 634 (Brazil: between Camps 45 and 46 on the Madeira-Mamoré R.R., and from Camp 39 to Camp 43, 300 to 350 kilom. above Porto Velho, Est. Matto Grosso). Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 45.

Helix (*Cochlogena*) *kremnoica* d'Orbigny, 1835, Mag. Zool., **5**, Class V, No. 61, p. 15 (Bolivia: Yuracarès).

Bulimus (*Bulimus*) *kremnoicus* Beck, 1837, Index Moll., pt. 1, p. 52.

Bulimus kremnoicus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 300 (with description of animal. In part: some specimens from Bolivia: village of Santa Rosa near Santa Cruz de la Sierra and country of the

Yuracare Indians); Pl. 35, figs. 1–2 only (type). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 25.

?*Strophocheilus popelairianus* H. v. Ihering, 1915, Commissão Linhas Telegr. Matto Grosso Amazonas, Annexo 5, Molluscos, p. 7 (Brazil: Tapiropoãn, Est. Matto Grosso; immature shell). Not of Nyst, 1845.

Sowerby originally described *maximus* from two shells, one of which was figured in 1838; their present location is unknown and they are not at the British Museum. The true holotype of d'Orbigny's *kremnoicus* (1837, Pl. 35, figs. 1–2) is at the British Museum (M. Connolly, *in litt.*, 1946).

Specimens Examined. Several without locality (M.C.Z.; A.M.N.H.) or labeled "Brazil" (A.M.N.H.). — PERU: One without more definite locality (A.M.N.H.). Río Ucayali (U.S.N.M.). Satipo near Huancayo, 600 m. (W. Weyrauch.–M.C.Z.). Pozuzo (M.U.Mich.) — BOLIVIA: Buena Vista, Prov. Sara (J. Steinbach.–M.U.Mich.; M.C.Z.). Rurrenabaque (W. M. Mann.–U.S.N.M.). Covendo, Beni River (W. M. Mann.–U.S.N.M.). — BRAZIL: Mutum on Rio Madeira, Est. Matto Grosso (Pinto.–M.U.Mich.). Camps 43 and 46, above Porto Velho, Est. Matto Grosso (Fred Baker.–M.C.Z.; Ac.N.S.Phila.).

Shell large (100 to 154 mm. long), light for its size, slightly translucent, elongate-ovate, widest a little below mid-length; spire slightly more tapering than base; the latter swollen, more or less saccate to the left of the columella. Summit broad, bluntly pointed; earliest nepionic whorls somewhat flattened. Whorls convex, separated by rather deep sutures; penultimate whorl more bulging than usual; spire much raised above the body-whorl; suture of body-whorl seen from the back more oblique than preceding suture. First and part of second whorls smooth; following nepionic whorls with close-set, strong, broad, slanting, curved riblets extending from suture to suture, about as wide as their intervals below the suture, but spreading farther down the whorl, where they tend to fade on latter half of third whorl; on penultimate and body-whorl riblets replaced by very low, irregular, short vertical folds below the suture, a few continuing very weakly to the base; body-whorl in addition more or less malleated, often scarcely so, the impressions sometimes arranged somewhat spirally. Granulose microsculpture very fine on early whorls, exceedingly weak and readily worn off on body-whorl. Aperture semi-elliptical, slightly oblique or nearly vertical. Parietal wall moderately calloused, sometimes with a distinct elongate hump near upper end. Columella narrow, thin, nearly straight; inner edge with a very slight fold in upper half; lower half evenly curved into base of outer lip; outer edge reflexed over the very narrow or almost closed umbilical slit. Outer lip moderately thickened and expanded; rim equally wide throughout, occasionally slightly accrescent in old age (up to 5 mm. wide). Periostracum, when well preserved, dark mahogany-brown, with many ill-defined lighter or yellowish-brown vertical streaks on body-whorl, more vinaceous-brown over early whorls; nepionic whorls usually with a paler subsutural band, sometimes faintly visible as far as body-whorl. Parietal wall and inside of mouth bluish-white; columella and outer lip white.

Typical *S. maximus* is very variable in size and shape, as shown by the table of measurements given below. Some specimens are extremely similar to *S. terrestris* of the same size (particularly of the subsp. *gummatus*); but they lack the microscopic vertical wavy wrinkles of the periostracum characteristic of *terrestris*. Sowerby's figured type was moderately slender, while Reeve's specimen (1848), from the Metcalfe Collection, was slightly wider. A shell, supposedly from Colombia, agrees well with Reeve's figure. Of the two specimens figured by d'Orbigny as *kremnoicus*, one (two upper figures) is almost exactly like Reeve's, and can only be referred to typical *maximus*; as the original description (1835) mentions only this broader form ("Longit. 12 cm.; latit. 7 cm."), figs. 1–2 of 1837 are here selected as representing the true type of *kremnoicus*.[1] Some of my specimens are relatively broader than any figured thus far, approaching *popelairianus* in outline, but with the relatively narrower mouth of *maximus*. There is so much variation in general shape that I was at first inclined to sink *vestitus* as a synonym of typical *maximus*. The presence or absence of the periostracum is of little importance, as shown by a study of my material as well as by d'Orbigny's remarks. He found some shells of what he called *kremnoicus* with the periostracum preserved and noted that old shells, even with live animals, tend to lose it, which led him to believe that the species may reach a ripe old age.

Pilsbry (1895) states that the generally larger size, more bulging penultimate whorl, broader contour and larger aperture seem to be the chief points differentiating *popelairianus* from *maximus*. He also calls attention to the smaller angle made by the columella with the parietal wall and the much broader spread of the reflexed columella upon the adjacent umbilical tract of the body-whorl, in *S. maximus*. All these peculiarities seem to be of little value in *Strophocheilus*, often varying within specific limits. Pilsbry later (1901, p. 120) expressed some doubt as to the specific distinctness of *popelairianus*. While the differences mentioned above hold in all specimens of *maximus* seen, it seems nevertheless probable that *popelairianus* will eventually be recognized as a geographical race only of *maximus*. Unfortunately too little is known of the distribution of *maximus*, particularly in the area where it might intergrade with *popelairianus*.

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[1] The description of 1837 is also based mainly on the broader form, the only measurements given being: length, 130 mm.; width, 75 mm.

Sowerby's figured type measures (in mm.): length, 131; greatest width, 68; aperture, 63 by 31; this is much less than the measurements in the original description, reproduced below. Reeve's figure 337 (1848) is 135 mm. long, 73 mm. wide, aperture 64 by 33 mm.; his fig. 208 (1848) is much smaller and more slender, being transitional to subsp. *vestitus*: length, 100 mm.; greatest width, 49 mm.; aperture 52 by 24 mm. d'Orbigny's fig. 2 of *kremnoicus* is 135 mm. long, 70 mm. wide, aperture 69 by 32 mm.[1]

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
154 mm	90	73	91	44	5½	Río Ucayali
130	72	60	71	32	5½	No locality
128	73	62	64	32	5½	Buena Vista
120	65	60	63	30	5½	Camp 39, Madeira
117	60	54.5	59	28.5	5½	Mutum
113	60	55	59.5	28	5½	Buena Vista
112	60	55	57	24	5⅓	No locality
110	62	56.5	55.5	31	5⅓	Pozuzo
110	57	49	53	24	5⅓	Satipo
106	53	49	55	24	5⅓	Rurrenabaque

The specimen from Pozuzo is transitional in shape between typical *maximus* and subsp. *huascari*.

Original description of *C. maxima*: "C. testa oblongo-ovata, spira producta, anfractibus rotundato-ventricosis, ore albo: long. 6 unc. [= 152 mm.], lat. 3½ unc. [= 89 mm.]. Two specimens of this shell are in the collection. It is principally distinguished from the two following, *viz.* 974 [*S. ovatus*] and 975 [*S. oblongus*] by its size, its ventricose volutions, and its white lip." Although Pilsbry says correctly that this description is not recognizable, there can be no doubt as to the identity of the species, one of the types being figured by Sowerby in 1838.

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[1] Mousson's (1873) supposed *maximus*, 140 and 160 mm. long, I refer to *S. popelairianus*.

b. S. MAXIMUS VESTITUS Pilsbry

Pl. 19, fig. 4

Bulimus kremnoicus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 300 (in part: some specimens from Bolivia: Yuracare, locality given in Explanation of Plates, p. 695, for fig. 3); Pl. 35, fig. 3 only. Not *Helix kremnoica* d'Orbigny, 1835.

Strophocheilus (*Borus*) *maximus* ? var. *kremnoicus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 16; Pl. 5, fig. 28 (after d'Orbigny's fig. 3); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Strophocheilus (*Borus*) *kremnoicus* subsp. *vestitus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6; Pl. 2, fig. 7 (Bolivia: probably Dept. Cochabamba).

Pilsbry's type and paratype of *vestitus* are at Ac.N.S.Phila. (No. 138105), where I have seen them. The holotype was not indicated, but I have selected as this the specimen originally figured and of which I give a new photograph.

Specimens Examined. BOLIVIA: Dept. of Cochabamba (probably), holotype and paratype of *vestitus* (J. Steinbach.-Ac.N.S.Phila.). — PERU: Oxapampa, 1,600 m. (W. Weyrauch.-M.C.Z.). Chilpes, 56 miles northeast of Tarma, 1,700 m. (J. A. Griswold, Jr.-M.C.Z.). Huancabamba, 10,000 ft. (M.C.Z.; U.S.N.M.). Río Ucayali (U.S.-N.M.).

The specimen from Oxapampa was collected with several *huascari*; it is somewhat intermediate between *huascari* and *vestitus*, but has the narrower outline of *vestitus*.

The persistence of the periostracum, on which Pilsbry based his *vestitus*, is of little importance. The name *vestitus* may, however, be retained for all slender specimens of *maximus*, with relatively wider spire, narrower body-whorl, and smaller mouth, as first figured by d'Orbigny in 1837 (Pl. 35, fig. 3). The name *kremnoicus* is not available for these, as it was originally (1835) based only on the broader, typical *maximus*. These slender specimens, probably individual variants only, are interesting in that they bridge the gap between typical *maximus* and the subsp. *huascari*. I have referred Reeve's fig. 337 (1848) to typical *maximus*, but it is clearly transitional to subsp. *vestitus*; it lacks the bulging penultimate whorl of *huascari*.

d'Orbigny's figure 3 is 137 mm. long, 60 mm. wide, the aperture 60 by 25 mm. Pilsbry's type of *vestitus* measured (in mm.): length, 118; diameter, 58; length of aperture, 56; in his figure the aperture is 24 mm. wide (inside the rim of the outer lip).

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
144 mm.	73	63	77	38	5½	Río Ucayali
122	59	52	62	27	5½	Oxapampa
118	61.5	52.5	63	27	5½	Huancabamba
112.5	52	48.5	56	24.5	5⅛	Chilpes
105	54	48	55	24.5	5⅓	"

c. S. MAXIMUS HUASCARI (Tschudi)

Pl. 29, fig. 3

Bulimus huascari v. Tschudi, 1852, in Troschel, Arch. f. Naturgesch., **18**, pt. 1, p. 186 (description of animal and shell by v. Tschudi. Peru: eastern slopes of the Andes between the Chanchamayo and Tulumayo Rivers). Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 13; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 212.

Bulimus (*Borus*) *maximus* var. *huascari* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192.

Bulimus (*Borus*) *huascari* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 5; Pl. 141, figs. 3–4 (Peru: specimen from Chanchamayo; not the type). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *huascari* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 16; Pl. 5, fig. 27 (after v. Martens); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Bulimus maximus var. β Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 19 (no locality; specimen from Cuming Coll., fully described, 98 mm. long, 52 mm. wide, the aperture 47 by 27 mm.); 1853, *Op. cit.*, **3**, p. 19 (with *B. huascari* Troschel as a synonym); 1859, *Op. cit.*, **4**, p. 365; 1868, *Op. cit.*, **6**, p. 10.

Bulimus maximus var. *minor* Troschel, 1852, Arch. f. Naturgesch., **18**, pt. 1, p. 186 (with *Bulimus huascari* Tschudi as a synonym). Not *Bulimus rosaceus* var. *minor* d'Orbigny, 1837.

?*Bulimus* (*Borus*) *proximus* var. *nana* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192 (without description; "Parahiba in Peru").

Bulimus (*Borus*) *sanctae-crucis* v. Martens, 1867, Malak. Blätt., **14**, p. 138 (description of 4 shells from Peru: Chanchamayo). Lubomirski, 1880 (April), Proc. Zool. Soc. London, for 1879, p. 721 (Peru: Amable María).

The present location of the type of *huascari* is not known to me.

The current interpretation of *huascari* is based on v. Martens' (1876) description and figures; but he did not see v. Tschudi's type. It should be noted also that neither Troschel nor Pfeiffer ever saw v.

Tschudi's shell, but only a drawing, which Pfeiffer referred (according to Troschel) to his small variety of *B. maximus* (1848). The name "var. *minor*" was first introduced in nomenclature for this form by Troschel, *B. maximus* var. *minor* and *B. huascari* being published on the same page.[1] Because of the earlier *Bulimus rosaceus* var. *minor*, preference must be given to the name *huascari*, used by later authors, particularly as it was proposed by v. Tschudi, who wrote the description. In the present paper I revert to Pfeiffer's original interpretation of *huascari*, which I believe is only a smaller, slightly more elliptical race of *S. maximus*.

Specimens Examined. PERU: Without more definite locality (A.M.N.H.; M.U.Mich.). Valle Chanchamayo, between 1,000 and 1,400 m., 20 fresh specimens (J. Schunke.–M.C.Z.). Río Toro near Chanchamayo, 1,300 m. (W. Weyrauch.–M.C.Z.). Oxapampa (W. Weyrauch.–M.C.Z.). Huancabamba (U.S.N.M.). Mountain 8 miles S. of Eten (M.U.Mich.). Chanchamayo (M.N.H.Chic.).

Although both typical *maximus* and subsp. *huascari* occur in Peru, it would seem that the latter occurs at higher altitudes than the former.

Shell medium-sized to large (88 to 116 mm. long), light, elongate-elliptical, broadest about mid-length, with the spire scarcely narrower than the base. Bulge of penultimate whorl as a rule relatively more pronounced, as compared with that of body-whorl, than in typical *maximus*; hence, the spire appears to be broader, although its relative length is about the same as in the typical form; the more pronounced bulge of the penultimate whorl also causes the suture of the last half of the body-whorl in back view to be markedly more oblique than in typical *maximus*. Aperture relatively narrower than in typical form. Parietal wall with a mere trace of a thickened area near upper end. Periostracum usually well preserved throughout life, mahogany-brown, with a few lighter and darker streaks on the body-whorl; rarely with a subsutural pale band on the nepionic whorls. The remainder and particularly the sculpture as in typical *maximus*. Peristome usually white, sometimes pale yellowish.

The original measurements given for the type of *huascari* were (in mm.): "alt. 105; long. 53 [evidently greatest width]." v. Martens' specimens were respectively 99 and 95.5 mm. long, 51 and 51 mm. wide, the aperture 52 by 24 and 49 by 23 mm.

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[1] Pfeiffer (1848) used the word "minor" merely as part of the descriptive phrase. Pfeiffer did not propose names for varieties in his Monographia, referring to them by Greek letters; although he sometimes quoted published or manuscript varietal names as synonyms.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
116 mm.	63	52	63	28	5½	Huancabamba
110	58.5	53	61	27	5½	Oxapampa
107.5	51	45	51	24	5½	Chanchamayo
104	54	50	54	25	5½	"
103	51.5	46	52.5	23.5	5½	"
102	54	49	53.5	24	5½	Oxapampa
101.5	52	47	52.5	23.5	5½	Chanchamayo
100	54.5	48.5	50.5	23	5½	Río Toro
98.5	54	48	50.5	23	5½	Chanchamayo
96.5	53	46	54	22.5	5½	"
95	51	47	52	22	5½	"
92.5	50	46	47.5	24.5	5½	"
91	49	43.5	48	22.5	5½	Eten
88	47	42.5	47	22.5	5½	Chanchamayo

The shells measured from Chanchamayo were mostly collected at the same time.

Original description of *B. huascari* by v. Tschudi (German text translated): "Testa rimata, oblongo-conica, fusca, striata, apertura oblique obtuso-ovata, coeruleo-rubicunda; peristomate aliquanto reflexo, sublabiato, albo. Animal blackish-brown, with yellowish-brown spots. Shell scarcely umbilicate; elongate conical, a little ventricose. Five whorls: first very small, flattened; second once again as large as first; third two and one-fourth times as large as second; fourth two and one-third times as large as third; fifth nearly three times as large as fourth. Length of aperture from beginning of outer margin to base a line [= 2.18 mm.] shorter than distance from beginning of outer margin to summit. Whorls therefore increasing very rapidly, separated by a not very deep suture. Aperture obliquely rounded ovate; inner columellar margin one-fourth shorter than outer margin. Proportion of length to width, 1 to 2. Peristome very slightly reflexed, but rather thick, blunt particularly at the outer margin, inside with a weak whitish false lip; outer margin [outer lip] rather strongly curved; inner margin [columella] nearly vertical, produced over the umbilicus, of which only the scarcely noticeable end remains. Peristome deeply depressed near the body-whorl. Special characters: shell with strong longitudinal striae, which produce deep grooves particularly on the second and third whorls. Color: main color of shell brown, somewhat olivaceous-green; first whorls always somewhat more reddish; body-whorl with obliterated yellowish and blackish vertical streaks; hind portion of body-whorl, behind the reflexed outer lip, blackish. Aperture reddish with bluish sheen, particularly on the inner side of the body-whorl, not translucent; peristome white. Varieties: almost entirely olivaceous-green or reddish-brown; sometimes with fairly well marked, whitish or yellowish spiral streaks, particularly toward the end on the under side of the body-whorl."

STROPHOCHEILUS (MEGALOBULIMUS) INDIGENS Fulton

Pl. 24, fig. 1

Strophocheilus (*Borus*) *indigens* Fulton, 1914, Proc. Mal. Soc. London, **11**, pt. 3, p. 165, fig. (Peru).

This species is known only from the type, which is now at the British Museum (M. Connolly, *in litt.*, 1946). As I have not recognized it in the material studied, I am reproducing both the original description and the figure, the latter said to be reduced about one-third. I was at first inclined to regard it as an unusual variant of *S. maximus huascari* (Tschudi) or *S. maximus vestitus* Pilsbry; but no decision could be reached without a study of the type.

Original description: "Shell ovate-oblong, yellowish-brown, moderately solid; spire about 13 mm. longer than the aperture; whorls 6½, apex smooth, the second and third whorls with prominent oblique plications, last two volutions polished and apparently smooth; but under the lens are seen to be finely granulated, the granulation being strong on the middle whorls, and gradually becoming weaker towards the aperture, the lower whorls have also some irregular and almost obsolete plications; aperture sub-oval, whitish within; peristome thickened and very slightly expanded, white, margins joined by a moderately thickened white callus. Alt. 110, diam. maj. 47 mm. The nearest species to this is *S.* (*Borus*) *huascari* Tschudi, which is broader, has a wider aperture, a rougher and duller surface, and its apical plications are much finer and closer together than in *indigens*."

STROPHOCHEILUS (MEGALOBULIMUS) POPELAIRIANUS (Nyst)

Pl. 11, fig. 5

Bulimus popelairiana Nyst, 1845, Bull. Acad. Bruxelles, **12**, pt. 2, No. 7, p. 151; Pl. 3, fig. 5 (South America).[1]

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[1] Germain's (1910) citation "Nyst, 1844, Bull. Acad. Bruxelles, t. xii, No. 7, Pl. IV, fig. 5" is erroneous. No. 7 of vol. **12** was published in 1845 and fig. 5 was an Plate 3.

Bulimus popelairianus Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 20. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 205. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 303. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 24. Pfeiffer, 1858, Malak. Blätt., **5**, p. 161; 1859, *Op. cit.*, **6**, p. 36; 1859, Monogr. Helic. Viv., **4**, p. 366; 1868, *Op. cit.*, **6**, p. 10. Haines, 1868, Cat. Terr. Shells Coll., p. 54. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 40 (Ecuador: Quito; Bodega; Napo). Orton, 1871, Amer. Naturalist, **5**, p. 696 and 697 (Ecuador: Napo). Hidalgo, 1872, Moluscos del Viaje al Pacífico, **1**, p. 46; Pl. 3, fig. 7. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 11; 1877, *Op. cit.*, **8**, p. 603. Dohrn, 1879, Jahrb. D. Mal. Ges., **6**, p. 187; 1880, *Op. cit.*, **7**, p. 87. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215. Hidalgo, 1900, Mem. Acad. Cienc. Madrid, **19**, (1893–1900), pp. 88, 192, and 318.

["Bulime sénestre," Chenu, 1847, Leçons Elém. Hist. Nat., p. 160, fig. 516 (shows a dextral shell)].

Bulimus (*Borus*) *popelairianus* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 3. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 223. Lubomirski, 1880 (April), Proc. Zool. Soc. London, for 1879, p. 720 (Peru: Palmal; Monte Rico). Reibisch, 1897, Naturf. Ges. Isis, Dresden, Abhandl., (1896), p. 57 (Ecuador: Nanegal). Germain, 1907, Bull. Mus. Hist. Nat. Paris, **13**, p. 55 (Ecuador: Santo Domingo de los Colorados; Nanegal); 1910, Miss. Mes. Arc. Mérid. Equat. Amér. Sud, **9**, Zool., pt. 3, p. C21.

Borus popelairianus Cousin, 1887, Bull. Soc. Zool. France, **12**, p. 212. Piaget, 1914, Mém. Soc. Neuchatel. Sci. Nat., **5**, p. 259. Standen, 1917, Jl. of Conch., **15**, p. 159 (egg). Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (egg).

Strophocheilus (*Borus*) *popelairianus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 13; Pl. 1, fig. 1 (after Hidalgo); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Strophochilus popelairianus Thiele, 1931, Handbuch System. Weichtierk., **2**, p. 650, fig. 704.

Strophocheilus popolairianus Hermano Daniel, 1942, Rev. Acad. Colombiana Cienc. Exact. Fis. Nat., **4**, Nos. 15–16, (1941), p. 374 (Colombia: Puerto Asís, Terr. Putumayo).

Bulimus (*Borus*) *topelairianus* Troschel, 1877, Arch. f. Naturg., **43**, pt. 2, p. 205 (misspelling of *popelairianus*).

Bulimus maximus Bland, 1852, in C. B. Adams, Contrib. to Conchology, No. 11, p. 229 (Colombia: Marmato; banks of Cauca River; Arma). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 24; Pl. 4, fig. 1 (Bolivia). Mousson, 1873, Malak. Blätt., **21**, p. 4 (northwestern South America, without definite locality). Not of Sowerby, 1825.

Bulimus popelairianus var. *maximus* "Hupé" Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216.

Bulimus (*Borus*) *popelairianus* var. *thammianus* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 4; Pl. 140, fig. 1 (Peru: Chanchamayo; Huallaga. Colombia: Upper Magdalena Basin); 1885, Conchol. Mitth., **2**, pts. 3–4, p. 15 (Ecuador: Nanegal, in the western Cordillera of Quito, 1,000 to 2,000 m.; Sta. Inés on the Río Pastaza, 1,244 m.).

Bulimus popelairianus var. *thammianus* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216.

Strophocheilus (*Borus*) *popelairianus* var. *thammianus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 14; Pl. 8, figs. 42–43 (*garcia-moreni*, after Miller); Pl. 9, fig. 49 (after v. Martens); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Borus popelairianus var. *thammianus* Piaget, 1914, Mém. Soc. Neuchatel. Sci. Nat., **5**, p. 259 (Colombia: El Cairo near Cauca, 892 m., Dept. Antioquia).

Bulimus (*Borus*) *popelairianus* var. *dohrnianus* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 4; Pl. 139, fig. 1 (fig. 2, by error, in text; no locality).

Strophocheilus (*Borus*) *popelairianus* var. *dohrnianus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 14; Pl. 3, fig. 10 (after v. Martens); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Bulimus popelairianus var. *dohrniensis* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216.

Bulimus (*Borus*) *popelairianus* var. *connectens* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 4; Pl. 139, fig. 2 (fig. 1, by error in text; Colombia: Upper Magdalena Basin).

Bulimus popelairianus var. *connectens* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216.

Strophocheilus (*Borus*) *popelairianus* var. *connectens* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 14; Pl. 2, fig. 1 (after v. Martens); 1902, *Op. cit.*, (2), **14**, Classification, p. iv.

Borus popelairianus var. *connectens* Piaget, 1914, Mém. Soc. Neuchatel. Sci. Nat., **5**, p. 259 ("forma *minor*"; Colombia; El Cairo near Cauca, Dept. Antioquia).

Bulimus valenciennesi v. Martens, 1867, Malak. Blätt., **14**, p. 135 (egg; Upper Amazon region of Peru-Brazil-Bolivia; synonymy according to Pfeiffer, 1876). Not of Pfeiffer, 1842.

Borus valenciennesi Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (cites v. Martens' description of egg of 1867).

Borus garcia-moreni Miller, 1878, Malak. Blätt., **25**, p. 172 (Ecuador: Nanegal; Val de Pilatón; Pisagua; Milagro; 500 to 1,500 m.); 1879, *Op. cit.*, (N.F.), **1**, p. 118 (Ecuador: common in the Prov. Esmeraldas, up to 3,000 ft. altitude); Pl. 4, figs. 1*a* (type) and 1*b* (egg).

Nyst's type of *popelairianus* is at the Brussels Museum of Natural History (under the No. 2738. — W. Adam, *in litt.*, 1946). v. Martens' types of *thammianus*, *dohrnianus* and *connectens* should be at the Berlin Museum. The whereabouts of the type of *garcia-moreni* is not known to me. The first definite localities of this species were published by Bland (1852) under the name *maximus*.

Specimens Examined. Colombia: San Pablo (M.U.Mich.). Marmato, Dept. Caldas (T. Bland.–A.M.N.H.; Ac.N.S.Phila.). Río Sucio, Dept. Antioquia (T. A. Link.–U.S.N.M.). — Ecuador: Emilio, east of S. Domingo de los Colorados (H. H. Bennett.–U.S.N.M.). Nachiyacu, between Baeza and Archidona, Oriente (U.S.N.M.). Prov. Guayas, 200 m. (O. Haught.–U.S.N.M.). Mera, Oriente del Norte, 4,000 ft. (F. X. Williams.–M.U.Mich.). Río Napo, Oriente (purchased in Quito by H. Frizzell.–M.C.Z.). Prov. Oriente, 3,000 ft. (F. X. Williams.–M.U.Mich.). Río Jatun Yacu, Oriente (W. Clarke-McIntyre.–M.C.Z.). San José de Mote (from P. Dautzenberg.–M.C.Z.). Río Mira near Guallupi, Prov. Imbabura (R. E. Stadelman.–M.C.Z.). Puyo, Río Pastaza, near Baños, Prov. Tungurahua, 2,000 m. (W. Clarke-McIntyre. –M.C.Z.). Méndez, Upper Paute River (M. W. Stirling.–U.S.N.M.). — Peru: San Ramón, Valle Chanchamayo, 800 m. (W. Weyrauch.–M.C.Z.). West-southwest of Pucallpa, toward the Río Uquaytia, Dept. Loreto (W. F. Walker, Jr.–M.C.Z.). Satipo near Huancayo, 600 m. (W. Weyrauch.–M.C.Z.). Balsapuerto, Dept. Loreto (J. Orton.–M.C.Z.). Between Satipo and Puerto Ocopo, Dept. Junín (W. F. Walker, Jr.–M.C.Z.). Tingo María, Río Huallaga, 700 m. (W. Weyrauch.–M.C.Z.). San Luis de Shauro, Río Paucartambo, 1,000 m. (W. Weyrauch.–M.C.Z.). Huancabamba (U.S.N.M.). Chanchamayo (M.U.Mich.). Achaya (B. Hubbard.–M.U.Mich.). Prov. Huallaga (B. Hubbard.–M.U.Mich.). Yuvini, Río Cosireni, 3,000 ft. (E. Heller.–U.S.N.M.). Also specimens labelled "Colombia" (M.C.Z.; A.M.N.H.).

Evidently common in some parts of Colombia, Ecuador and Peru. I agree with Pilsbry that the occurrence in Bolivia (after Hupé, 1857) needs confirmation, although Hupé's figure is certainly *popelairianus*.[1] The snail was used as food in Ecuador as late as 1879, being offered for sale in city markets, and the custom perhaps prevails even to-day in certain districts. A note by O. Haught, with the shell from Prov. Guayas, states that the living animal is conspicuously bright orange. Miller (1878) described the egg, which is elliptical, white, smooth, 47 to 51 mm. long, 28 to 35 mm. wide. The newly hatched shell is slightly keeled at the periphery of the last whorl, very thin, golden-yellow, and measures 41 mm.

[1] H. v. Ihering's record of *S. popelairianus* from Tapirapoan, Matto Grosso (1915, Commissão Linhas Telegr. Matto Grosso Amazonas, Annexo 5, Molluscos, p. 7) was based on an immature shell, 37 mm. long, said to have already ⅓ of the first post-nepionic whorl, therefore far too small for true *popelairianus* of that age. I have referred the record tentatively to *S. maximus*.

S. popelairianus is the largest species of the genus and next to the largest living terrestrial snail known. Shell 110 to 163 mm. long, rather thick, very bulky, nearly opaque, very broadly ovate, with the greatest width well below mid-length; spire much more tapering than base. All whorls more swollen than usual, with deeper sutures; body-whorl very large, about three-fourths of total length in front view, much more ventricose than penultimate whorl, swollen even at base, where it is somewhat saccate to the left of the columella. Summit raised, bluntly pointed, with all nepionic whorls well visible in front view. On the nepionic shell, about the first whorl smooth; then appear rather close-set, evenly spaced, strong, flat riblets, with intervals about as wide as a riblet at the upper suture, at first parallel, but slanting and curved, later slightly spreading or fading toward the lower suture; riblets more numerous and more parallel than in *S. maximus.* Axial sculpture very weak on post-nepionic whorls, almost lacking on body-whorl, which shows only very superficial growth-striae and a more or less developed malleation (very variable and sometimes scarcely visible). Microsculpture of much finer granules than usual, exceedingly minute on the early nepionic whorls between the riblets (even on very young shells), best developed on penultimate whorl where they are placed in crowded spiral rows, nearly lacking over most of body-whorl which is shiny and shows no trace of microscopic vertical striolae. Aperture more rounded and wider than in most other species, very broadly elliptical to subcircular, except for the bulge of the parietal wall in the upper inner third. Columella very slightly arched, continued evenly in the base of the outer lip, which is also regularly and evenly curved and joins the body-whorl at a nearly straight angle; callus of parietal wall of medium thickness, often with a distinct hump-like swelling close to the upper end. Columella flattened in the upper part, its outer rim spread over the umbilical slit, which usually remains open, though very narrow. Outer lip thick, moderately expanded, of equal width throughout, straight and slightly oblique in profile; rim moderately accrescent in old age (up to 8 mm. wide). Suture of body-whorl seen from the back no more slanting than the preceding suture. Periostracum often well preserved even in old age, dark mahogany-brown, usually with darker chestnut stripes on the body-whorl, more reddish-brown on the earlier whorls, which generally bear a paler or whitish sub-sutural band, sometimes present even on the body-whorl of weathered shells. Inside of aperture bluish-white. Columella, parietal wall and outer lip white.

Although *S. popelairianus* is no doubt very closely related to *S.*

maximus, I regard it provisionally as a distinct species on the strength of the following characters. (1) The nepionic riblets are slightly more crowded and more parallel than in *maximus*. (2) The body-whorl is strongly ventricose and somewhat saccate at the left base, while the penultimate whorl is more bulging, all sutures being deeper. (3) The aperture is relatively shorter and wider, with a very convex outer lip. Some specimens are nevertheless difficult to place and it may well be that *popelairianus* will eventually be treated as no more than a giant race of *maximus*. The differences from *S. valenciennesii* are very clear and are discussed under that species.

S. popelairianus varies a great deal in size, shape, and development of malleation; but the differences are never clear-cut nor correlated with geographical distribution in the material I have seen. I am unable to recognize as distinct races any of the forms named by v. Martens. In the long series from Ecuador every type of malleation is represented, some specimens being as strongly sculptured as a large shell from Chanchamayo (one of the type localities of *thammianus*). In the series from Río Napo, some shells have a well-developed tubercle on the parietal wall, others show no trace of it. Moreover, this tubercle is formed only in old shells.

One might be inclined to retain var. *dohrnianus*, owing to the dorso-ventral compression of the shell and the rather peculiar dark-edged peristome and parietal wall, the latter features not mentioned in the original description. One shell from San Luis de Shauro shows all these peculiarities, yet is clearly *popelairianus*; moreover, it has a strong tubercle on the parietal wall, said to be lacking in the type of *dohrnianus*.

Nyst gave the measurements of the type of *popelairianus* as: length, 150 mm.; width, 85 mm.; but his figure is 154 mm. long and 97 mm. in greatest width (85 mm. being the width of the body-whorl above the aperture), with the aperture 80 by 48 mm. According to Dr. W. Adam, the type at the Brussels Museum is only 136 mm. long and 84 mm. in greatest width. It is also now more yellowish than shown in the original figure. The measurements (in mm.) of v. Martens' four cotypes of *thammianus* were respectively: length, 147 (figured specimen), 141, 138, and 126; width, 89, 86, 83, and 73; aperture, 76, 72.5, 73, and 68 by 44, 40, 40, and 36.5 (width inside the rim of the outer lip). His type of *dohrnianus* was 145 mm. long, 95 mm. wide, the aperture 83 by 44 mm.; and his three cotypes of *connectens* were respectively 141, 134, and 131 mm. long, 89, 81, and 78 mm. wide, the aperture 81, 71, and 72 by 40, 39, and 40 mm. Miller gave the measurements (in mm.)

of his *garcia-moreni* as: length, 141 to 147; greatest diameter, 71 to 85; least diameter, 63 to 71; aperture, 68 to 78 by 48 to 57; the figured type is 143 mm. long and 89 mm. in greatest width, with the aperture 77 by 43 mm. Mousson recorded (as *maximus*) specimens 140 and 160 mm. long.

Measurements of Adult Shells

	Width in front view	Width in profile	Aperture			
Length			Length	Width	Whorls	
163 mm.	104	80	92.5	46.5	5½	S. José de Mote
156	100	75	82	47.5	5½	Pucallpa
147	90	70	80	44	5½	Río Sucio
142	79	67.5	75.5	38	5½	Prov. Guayas
138	91	68	75	42	5½	Río Napo
137	78	62.5	73.5	41	5½	Marmato
137	76	62	71	36	5½	Colombia
137	79	54	77	37	5½	Balsapuerto
134	80	64	72.5	36.5	5½	Pucallpa
132	77	64	74	42	5½	Río Mira
130	79	63	78	38	5½	Balsapuerto
126	80	68	73	39	5½	Río Napo
122	71	62	67.5	35	5½	Balsapuerto
118	73	58	66	39	5½	Nachiyacu
116.5	72	64	66	36	5½	Prov. Guayas
110.5	63	50	56.5	34	5½	Marmato

The average length of these 16 specimens is 135.5 mm. and the average greatest width 80.5 mm.

Original description of *B. popelairiana* (French text translated): "Testa maxima, crassa, ovato-oblonga, ventricosa, subcompressa, subperforata, longitudinaliter striato-rugosa, fusca; anfractibus sex convexis, rapide crescentibus, tribus supremis plicatis, quarto et quinto transversim granulosis; ultimo obliquo, nitido, sutura albomarginato; apertura ovali intus albida superne subedentula, columella labroque albis, crassis, reflexis. This *Bulimus* has some relationship with *B. ovatus* Müller, *B. cantagallanus* and *granulosus* Rang. It is oval, oblong, very ventricose below, slightly compressed, thick and perforate. The spire, of six convex whorls, separated by a deep suture, margined with a white streak on the last two whorls, is obtuse, whitish at the summit as well as on the upper portion of the first four whorls. These are in addition covered with longitudinal, oblique folds weakening into irregular striae on the following whorls, which are in addition very finely granulose transversely. The granulation disappears on the middle of the penultimate whorl. The shell is brown, only the last whorl is much darker, very shiny and interrupted by blackish-brown longitudinal flammules. The aperture is oval and small in proportion to the size of the shell, whitish inside; its right margin is rounded off and reflexed outwardly. The left margin is thick, little spreading and provided on its upper portion with a slight callosity; it unites with the right margin and the columella, the latter thick and reflexed over the umbilical slit which it closes almost completely. The aperture is beautifully ivory-white all around."

STROPHOCHEILUS (MEGALOBULIMUS) VALENCIENNESII (Pfeiffer)

Pl. 15, fig. 4; Pl. 20, fig. 6

Bulimus valenciennesii Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 52 ("Brasil int."; with *Bul. fulguratus* Val. Mus. Par. — Beck, p. 53, as synonym). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 162. Philippi, 1846, Abb. Beschr. Conch. **2**, pt. 5, p. 123; Pl. 5 (*Bulimus*), fig. 1 (Pfeiffer's type). Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 18. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 211. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 28 (Brazil; in part: not the variety); Atlas, Pl. 146, figs 1–2 (Expl. of Plates, p. 20). Pfeiffer, 1853, Monogr. Helic. Viv., **3**. p. 303. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Pfeiffer, 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 249; Pl. 68, fig. 3. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 24. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 365. A. D. Brown, 1861, Cat. Shells Coll., p. 49; 1866, *Op. cit.*, 2d Ed., p. 62. Haines, 1868, Cat. Terr. Shells Coll., p. 57. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 10. Paetel, 1869, Moll. Syst. Cat., p. 80; 1873, Cat. Conch.-Samml., p. 99. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 12; 1877, *Op .cit.*, **8**, p. 604. Hidalgo, 1900, Mem. Acad. Cienc. Madrid, **19**, (1893–1900), p. 122.

Bulimus (*Borus*) *valenciennesii* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 10. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 223.

Corus (*Bulimus*) *valenciennensi* Jousseaume, 1877, Bull. Soc. Zool. France, **2**, p. 311.

Strophocheilus (*Borus*) *valenciennesii* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 21; Pl. 7, fig. 7 (after Philippi); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus popelairianus var. *valenciennesi* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216.

Bulimus valensiennesii Jay, 1850, Cat. Shells Coll., 4th Ed., p. 197 (misspelling of *valenciennesii*).

Bulimus fulguratus ["Valenc." Beck, 1837, Index Moll., pt. 1, p. 53; *nomen nudum*] Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 52 (as a synonym of *B. valenciennesii*). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 197. Not *Bulimus fulguratus* Jay, 1842, which Pfeiffer stated was published before Pt. 2 of his Symbolae.

Bulimus popelairianus Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 34, figs. 204*a-b* (Brazil). Not of Nyst, 1845.

The type of *valenciennesii*, described from Pfeiffer's collection, may be in the Stettin Museum.

Specimens Examined. BRAZIL: Several without definite locality (M.C.Z.; U.S.N.M.; A.M.N.H.) and two labelled "Bahia" (A.M.N.H.).[1] —ECUADOR: one shell without more definite locality, the label probably erroneous (M.U.Mich.). — PERU: one shell labelled "Alto Peru," another rather doubtful locality (U.S.N.M.).

No reliable definite locality is known for this very puzzling form. Following Pfeiffer's original description, Deshayes (1851) redescribed the species from 2 specimens, probably both at the Paris Museum. One of these had the characteristic zigzag markings and may have been the shell originally labelled *fulguratus* by Valenciennes (mentioned by Pfeiffer, 1842), although this is not stated. The other shell lacked the zigzag markings and Deshayes seems to have been in some doubt as to whether it was not *S. popelairianus* (Nyst). He also referred Pl. 146, figs. 1–2, of Férussac's Atlas to *valenciennesii*, as they show the characteristic zigzag markings; but it not certain that these figures were drawn from one of the two shells seen by Deshayes. In any case, I do not understand why Pilsbry omitted these figures from his synonymy of *valenciennesii*. Deshayes noted that the "zigzags appear to be caused by the lack of periostracum." They appear first, however, as areas of lighter (perhaps diseased?) periostracum. Deshayes was inclined to unite *valenciennesii* and *popelairianus*, keeping them distinct only to abide by Pfeiffer's opinion. All authors agree that Reeve's (1848) supposed *popelairianus*, from the Dennison Collection, was *valenciennesii*; but Reeve regarded the two names as synonymous. Pfeiffer's later figure (1855) [2] was not drawn from the original type.

Pilsbry writes in his discussion of this species: "The zigzag markings of light yellow cuticle or denuded, are characteristic. This species, like *B. popelairianus*, is depressed on the back. It differs conspicuously from that species in the weak sculpture of the earlier whorls. The last whorl, when examined with a strong lens, shows an excessively fine, dense longitudinal striolation, somewhat less distinct that in *B. proximus* [= *S. terrestris* Spix], but of the same character. This is an excellent distinctive character of these species, which does not occur in the *popelairianus-granulosus* series, nor indeed in any other group of *Borus*." Taking up these points in succession: (1) The zigzag markings are, as noted above, scars due to loss by flaking of the periostracum, preceded, I believe, by a diseased condition spreading between the lime of the shell and the cuticle. This alteration, in the *valenciennesii* seen, is not restricted to the zigzag areas, but occurs also elsewhere as irregular blotches, spots or streaks. Alteration of a similar nature, but irregularly distributed, may be observed in some specimens of *popelairianus* from Peru and Ecuador. Moreover, v. Martens states in the description of his *B. popelairianus* var. *thammianus*: "cuticle lost in spots or streaks, rarely in zigzags." When the periostracum is worn away over much of the shell, as may happen even during life in old individuals, this character cannot be recognized. (2) The nepionic whorls of ten *valenciennesii* seen have the vertical riblets lower and somewhat farther apart than in *popelairianus* with well-preserved summit, being about as in the specimens of *S. terrestris*; but the difference is exceedingly slight. (3) The microscopic, dense, vertical striolation of the body-whorl is easily detected in the ten *valenciennesii* seen, consisting of minute interrupted raised lines or wrinkles of the periostracum and being lost with the latter. It gives the shell a dull appearance. I am unable to find even a trace of this in any specimen of *popelairianus*. Particularly owing to this last peculiarity, I now regard *valenciennesii* as specifically distinct from *popelairianus*.

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[1] This locality "Bahia" appears to be a guess, as the specimens came originally from the Haines Collection, other specimens from the same source being merely labelled "Brazil." Haines (1868) does not mention the locality in his Catalogue.

[2] Pfeiffer in 1853 (Monogr. Helic. Vic., **3**, p. 303) cited the reference to the Syst. Conch. Cab., but by number only (No. 354), not by page. The date of publication of p. 249 of Syst. Conch. Cab. is 1855.

Pilsbry noted that the microsculpture of the body-whorl is the same in *S. valenciennesii* and *S. terrestris* (= *cantagallanus*), while the riblets and granulation of the nepionic whorls are very similar. Possibly therefore *valenciennesii* may be merely a very large form of *S. terrestris*; but this can only be settled definitely by determining its exact habitat on fresh material. The two differ mainly in size and contour, *valenciennesii* reaching up to 140 mm. in length and 86 mm. in width; although Pilsbry mentions one only 115 mm. long and 78 mm. wide. On the other hand, the largest known typical *terrestris* is the specimen described by v. Martens as *intercedens*, which was 110 mm. long and 69 mm. wide,[1] closely approaching in size and proportions Pilsbry's smallest *valenciennesii*. Some specimens of *S. terrestris*

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[1] v. Martens' figure shows a relatively narrower shell than these measurements indicate.

gummatus also are somewhat similar in size and even in shape to *S. valenciennesii.*

In all adult specimens seen the parietal wall is much thickened, sometimes with an adnate, low crest along the left edge, and with the upper part swollen into a distinct hump. The outer lip is thick, moderately accrescent in old age, up to 8 mm. wide behind the rim and somewhat overhanging the adjoining surface of the body-whorl. Columella, parietal wall and outer lip are white, and there is often a pale subsutural band, at least on the earlier whorls. In most of these characters also the species agrees with *S. terrestris,* while it shares the saccate left base of the body-whorl with both *terrestris* and *popelairianus.*

Pfeiffer gave the original measurements as: "Long. 140, diam. 80 mm."; but the figure of the type is slightly larger: 142 mm. long, 86 mm. in greatest width, the aperture 80 by 41 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
131 mm.	87	67	77.5	41.5	5	Brazil
130	88	65	77.5	41	5	"
123	84.5	68	74.5	41	5	"
120	78	67	74.5	41	5	Ecuador (?)

STROPHOCHEILUS (MEGALOBULIMUS) TERRESTRIS (Spix)

a. Typical TERRESTRIS

Pl. 7, fig. 5; Pl. 18, fig. 1

Bulimus terrestris Spix, 1827, in Wagner, Test. Fluv. Brasiliam, Pl. 6, fig. 1 (with name), and p. 5 of text (as a synonym of *Bulimus corrugatus* Wagner, 1827). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 210.

Bulimus ovatus var. *terrestris* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215.

Bulimus corrugatus Wagner, 1827, in Spix, Test. Fluv. Brasiliam, p. 5; Pl. 6, fig. 1 (young shell; Brazil: southern part of the state of Bahia). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 193. Not *Bulimus corrugatus* Bruguière, 1792.

Bulimus ovatus var. *corrugatus* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215.

Helix (*Cochlogena*) *cantagallana* Rang, 1831 (September), Ann. Sci. Nat., **24**, p. 50 (Brazil: district of Cantagallo, Est. Rio de Janeiro). d'Orbigny, 1835, Mag. Zool., **5**, Class V, No. 61, p. 15. Moricand, 1836, Mém. Soc. Phys. Hist. Nat. Genève, **6**, pt. 2, p. 430.

Bulimus cantagallanus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 300 (northern and eastern provinces of Brazil). Deshayes, 1838, in Lamarck, Hist. Nat. Anim. sans Vert., 2d Ed., **8**, p. 238; 1844, *Op. cit.*, 3d Ed., **3**, p. 353. A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 20. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 152. Porro, 1846, Coll. Mus. Modiol., Moll. Terr. Fluv., p. 13. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 20; 1852, Zeitschr. f. Malak., **9**, p. 100. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Hupé, 1857, Anim. Nouv. Rares Exped. Amer. Sud de Castelnau, **3**, Moll., p. 25. Pfeiffer, 1858, Malak. Blätt., **5**, p. 161; 1859, Monogr. Helic. Viv., **4**, p. 365 (in part: references only); 1868, *Op. cit.*, **6**, p. 10 (in part). Haines, 1868, Cat. Terr. Moll. Coll., p. 45. Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 43 (Rio de Janeiro); 1872, Moluscos del Viaje al Pacífico, **1**, p. 50. Paetel, 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Malak. Blätt., **23**, p. 198; 1876, Monogr. Helic. Viv., **8**, p. 12 (in part). Dohrn, 1883, Jahrb. D. Mal. Ges., **10**, p. 347 (Brazil: mountains north of Rio de Janeiro; Upper Mucury River, Est. Bahia). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 209. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 67 and 89.

Bulimus (*Bulimus*) *cantagallanus* Beck, 1837, Index Moll., pt. 1, p. 53. Anton, 1839, Verzeichniss Conch.-Samml., p. 40.

Bulimus (*Borus*) *cantagallanus* Albers, 1850, Die Heliceen, pp. 142 and 145 (description of 2 specimens, one 106 mm., the other 83 mm. high). Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 12; Pl. 138, figs. 1–2 (2 cotypes of *B. accelerans* v. Martens, 1867). G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 121. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119.

Strophocheilus (*Borus*) *cantagallanus* Pilsbry, 1895, Man. Conch., (2), **10**, p. 22; Pl. 16, fig. 24 (*proximus*, after Sowerby); Pl. 17, figs. 28–29 (specimen) (Brazil: forest region generally from Rio to Bahia); 1901, *Op. cit.*, (2), **14**, p. 122; 1902, *Op. cit*,.(2), **14**, Classification, p. v. F. Baker, 1914, Proc. Ac. Nat. Sci. Philadelphia, (1913), p. 634 (Brazil: Carnaubinha near the head of the Natal estuary, Est. Rio Grande do Norte). Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 45.

Borus cantagallanus Standen, 1917, Jl. of Conch., **15**, p. 159 (egg).

Strophocheilus (*Megabulimus*) *cantagallanus* Haas, 1935, Arch. f. Molluskenk., **67**, p. 110 (Brazil: João Pessoa, Est. Parahyba).

Strophocheilus (*Megalobulimus*) *cantagallanus* Haas, 1939, Senckenbergiana, **21**, p. 268 (Brazil: Macapá near Princesa, Est. Parahyba).

Bulinus proximus Sowerby, 1838 (October 31), Conchol. Illustr., *Bulinus*, fig. 102 of Pt. 146 (name in accompanying letterpress list; no locality).

Bulimus proximus Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 159. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 20. Reeve, 1849, Conch. Icon., **5**, *Bulimus*, Pl. 82, fig. 607. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 206. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 303. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 24. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 365. A. D. Brown, 1866, Cat. Shells Coll., 2d Ed., p. 59. Haines, 1868, Cat. Terr. Shells Coll., p. 54. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 10. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 12; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216. Plate, 1896, Sitzungsber. Ges. Naturf. Fr. Berlin. p, 149 (anatomy).

Bulimus (*Borus*) *proximus* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1879, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 11. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Bulimus (*Borus*) *accelerans* v. Martens, 1867, Malak. Blätt., **14**, p. 137 (no locality). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Bulimus accelerans Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 10; 1876, *Op. cit.*, **8**, p. 12; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 207.

Bulimus intercedens v. Martens, in Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 13; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 212.

Bulimus (*Borus*) *intercedens* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 14; Pl. 141, figs. 1–2 (Brazil: Bahia). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *cantagallanus* var. *intercedens* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 23; Pl. 10, figs. 53–54 (after v. Martens); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

The type of *terrestris* was at the Munich Museum, that of *corrugatus* being the same shell. The type of *cantagallana* cannot now be traced at the Paris Museum (E. Fischer, *in litt.*, 1947); it has never been figured. The types of *accelerans* and *intercedens* should be at the Berlin Museum. The present location of the type of *proximus* is unknown; it could not be found at the British Museum (M. Connolly, *in litt.*, 1946).

H. Dohrn (1883) first recognized that *terrestris* (or *corrugatus*) *cantagallana*, *proximus*, *accelerans*, and *intercedens* were one and the same species; but he refused to use one of the earlier two names, because they were based on a young shell, the identity of which might be open to doubt. Spix' figure, however, cannot be confused with the young of any other species, particularly not with that of *S. ovatus.*

The rather pointed summit, with narrow early whorls, is characteristic. Moreover, *S. ovatus* is not known to occur in the state of Bahia. I am unable to separate v. Martens' *intercedens*, even as a variety.

Specimens Examined. BRAZIL: several without more definite locality (A.M.N.H.; M.N.H.Chic.; M.C.Z.; M.U.Mich.). Est. Ceará (Dias de Rocha.–M.C.Z.; M.U.Mich.). Est. Bahia (A.M.N.H.). Campo Formoso, Est. Bahia (A. Hermanno.–M.C.Z.). Bahia, Est. Bahia (Hartt and Copeland.–M.C.Z.). Salgado, Est. Bahia (Thayer Exp.–M.C.Z.). Itapicurú River, Est. Bahia (H. S. Washington.–M.C.Z.). Fazenda Cana Brava, Ouriçangas, Municipio de Irará, Est. Bahia (Mello Jr.–M.C.Z.). Nova Olinda, Municipio de Itapicurú, Est. Bahia (Mello Jr.–M.C.Z.). Riacho da Guia, Alagoinhas, Est. Bahia (Mello Jr.–M.C.Z.). Amparo, Municipio de Cipó, Est. Bahia (Mello Jr.–M.C.Z.). Baudiera do Mello, Est. Bahia (H. S. Washington.–U.S.N.M.). Machado, Portella, Est. Bahia (Rose and Russell.–U.S.N.M.). Corcovado, Est. Rio de Janeiro (M.U.Mich.). Piquete, Est. São Paulo, one young shell (H. v. Ihering.–U.S.N.M.). Nova Troviso, Est. Santa Catharina (J. F. da Rocha.–M.C.Z.).

Although restricted to eastern Brazil, *S. terrestris* appears to be rather widely distributed, since it is known from the states of Ceará, Rio Grande do Norte, Parahyba, Bahia, Rio de Janeiro, São Paulo and Santa Catharina. No doubt it will be found also in the other states of this general area, some of the subspecies being known from Pará, Paraná, and Sergipe.

Typical *S. terrestris* is medium-sized (77 to 110 mm. long), light, nearly opaque, broadly ovate in outline, widest slightly below midlength. Spire very short, more tapering than base; summit bluntly pointed; all nepionic whorls distinctly raised above one another. Body-whorl much swollen, somewhat saccate to the left of the columella, its suture seen from the back more oblique than the one above it. First and beginning of second nepionic whorl smooth; then appear broad, flat, oblique and slightly curved riblets, at first about as wide as their intervals and extending from suture to suture; later more spaced, spreading apart downward and gradually disappearing toward the lower suture. Most of penultimate and body-whorl with slight, irregular, short vertical folds below the suture. Microsculpture of the usual fine, spirally placed granulation, almost completely lacking on the body-whorl, where instead the periostracum bears exceedingly close, microscopic, wavy, vertical striolae. Body-whorl usually with very weak malleation, arranged more or less transversely so as to form superficial, shallow, and ill-defined spiral grooves, particularly behind the outer lip. Aperture semi-elliptical, slightly oblique, its lower inner edge well to the left of the vertical axis of the shell. Parietal wall moderately calloused, with a more or less pronounced hump near the upper end. Columella narrow, moderately thickened, nearly straight or very broadly arched, curving evenly into the base of the outer lip. Umbilical slit usually very narrow or almost obliterated; but in 2 shells broadly open, perforate. Outer lip moderately thickened and expanded; rim equally wide throughout, usually not accrescent in old age. Periostracum of adult shells usually preserved only on body-whorl, which is then olivaceous-brown with a few darker chestnut-brown vertical streaks; earlier whorls purplish-brown. A dirty-white subsutural band, usually continued to the aperture. Parietal wall and inside of aperture bluish-white; columella and outer lip pure white in all the many specimens seen.

I have discussed the relations of *S. terrestris* and *S. valenciennesii* under the latter, reaching the conclusion that they are most probably only subspecifically distinct. As shown below, I regard *S. gummatus* as a subspecies of *S. terrestris*.

Rang's type of *cantagallanus* was 85 mm. long and 58 mm. wide. Sowerby's figure of the type of *proximus* measures 101 mm. in length, 66 mm. in greatest width, the aperture 60 by 32.5 mm. v. Martens' two cotypes of *accelerans* were respectively 110 and 90 mm. long, 74 and 57 mm. wide, the aperture 66 by 36 mm. and 54.5 by 25 mm.; the type of his *intercedens* was 110 mm. long, 69 mm. wide, the aperture 63.5 by 42 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Width	Whorls	
106 mm.	59	50	56	30	5½	Brazil
104	64	54	61	27	5½	Bahia
97	54	48	55.5	24	5½	Brazil
96	64	50	57	27.5	5½	Faz. Cana Brava
90.5	59	48	54.5	25	5½	Bahia
88.5	55	46	56.5	23	5½	Faz. Cana Brava
84	53	43	52	23.5	5½	"
81	51.5	44	50	22	5½	Itapicurú R.
77.5	50	43	48	21.5	5½	"

Original description of *B. terrestris* (= *B. corrugatus*): "B. testa ovata, ventricosa, subperforata, longitudinaliter striatorugosa, albida, spira pallide carnea; apertura ovato-oblonga; labro acuto. Testa oblongo-ovata, ventricosa, solida sed non crassa, pellucida, epidermide tenui vestita. Anfractus sex convexi; ultimus maximus, ventricosus, spira fere triplo major, striis longitudinalibus crebris subrugosis. Spira conica; anfractibus subconvexis, striis longitudinalibus elevatis, obliquis, versus marginem inferiorem evanescentibus praeditis. Apertura ovato-oblonga. Labrum acutum; margine sinistro versus columellam subreflexo, rimam umbilicarem angustam formante. Color testae rubello-albidus; spira pallide carnea; apertura alba. Epidermis sordide olivacea."

Original description of *H. cantagallana* (French text translated): "Testa ovata, ventricosa, crassa, exile atque longitudinaliter striata, antice fulva, postice castanea; apice obtusa, albida; ultimo anfractu magno, oblique posito, striis transversalibus postice notato; suturis fascia albida marginatis; apertura ovali; columella labroque albis, crassis, reflexis; intus alba. *H. cantagallana* is ovoid, ventricose, compressed dorso-ventrally, of thick texture, nearly opaque, finely and longitudinally striate over the surface. If looked at carefully and with a lens, the body-whorl shows, in addition to the fine growth-striae, very many extremely fine striae which the bare eye could never detect; while all the other whorls, of a dark color, have the surface finely punctulate and, as it were, weathered. This character, constant in this species, is not found in any other to my knowledge. This helix is striking by having two contrasting colors at the anterior suture: on the spire or upper portion a dark brown much like chestnut, and on the body-whorl a more or less pale tawny; the two colors merge gradually toward the beginning of the body-whorl. The spire, little raised, makes almost six whorls, which are little rounded; the body-whorl, larger than all the others together, has behind its middle a few transverse, broad striae, sometimes scarcely visible. The summit is obtuse; the sutures are margined anteriorly with a rather broad whitish band, and the last suture is a little more oblique than the others. The aperture is oval, longer than wide, and occupies slightly over half the length of the shell; its plane is parallel with the axis and its direction is slightly oblique to the axis. The columella is thick, rounded and arched at the inner edge; it unites without break with the right margin, which is thick, reflexed as a rim and always white, like the columella." Rang mentioned also some differences from *S. oblongus* and *S. ovatus*. "*H. cantagallana* is shorter and yet more ventricose than *H. oblonga*. It is compressed dorso-ventrally, which never happens in the latter; the spire is less raised, the surface is much less striate; the plane of the aperture is parallel to the axis instead of being oblique; the columella far from being straight, is arched and forms no angle with the outline of the convexity of the body-whorl; finally, the columella, the right margin and the inside of the shell are very white, whereas in *H. oblonga* the columella and right margin are purplish and the inside fulvous-white." "*H. cantagallana* is at least one-half smaller than *H. ovata*; proportionately shorter and more ventricose; the surface, instead of being strongly malleate, is lightly marked with growth-striae; the margins of the aperture are never purplish; finally the columella forms an arch with the outline of the convexity of the body-whorl instead of forming an angle."

b. S. TERRESTRIS OOSOMUS Pilsbry

Pl. 5, fig. 1

Strophocheilus (*Borus*) *oosomus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 27; Pl. 18, figs. 32–33 (Brazil); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

I have seen the type at Ac.N.S.Phila. (No. 32810).

Specimens Examined. BRAZIL: without more definite locality, holotype (Ac.N.S.Phila.) and three other specimens (A.M.N.H.). Morrêtes, Est. Paraná (M.C.Z.). Antonina, Est. Paraná, one worn adult, subfossil (M. J. de Oliveira.–M.C.Z.) and one worn, but rather fresh adult (M.U.Mich.). Curuçá, Est. Pará (L. Agassiz.–M.C.Z.). — Also an immature shell without locality (M.C.Z.) and an adult from "Amazonas" (M.U.Mich.).

I am retaining the name *oosomus* provisionally for obese specimens of *terrestris* with very convex body-whorl and short, broad spire, as a rule with less pointed summit and less flattened dorso-ventrally. These have, however, the nepionic sculpture of *terrestris*, which is likewise present in Pilsbry's type. The outer lip may be white or pinkish. It is white in the type specimen, as well as in the fresh specimen, covered with periostracum, from "Amazonas." It is pink or pinkish in the shell from Curuça (although this is much weathered) and in the better preserved specimens from Antonina and Morrêtes.

Pilsbry gave the following measurements of the type: "Alt. 81, Diam. 54 mill.; aperture alt. 42, width outside col. callus and perist. 37, width of cavity 24 mill." His figure is, however, slightly larger and agrees better with the specimen, which is included in the subjoined table.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
108.5 mm.	65	56	68.5	30	5½	Antonina
107	69	56.5	65	32	5½	Brazil
99.5	58	53.5	61	28	5½	Curuçá
99	64	53.5	61	28.5	5½	Antonina
88	55.5	48	55.5	24	5½	"Amazonas"
85.5	57	47.5	53	24	5⅓	Holotype

c. S. TERRESTRIS GUMMATUS (Hidalgo)

Pl. 17, fig. 6

Bulimus gummatus Hidalgo, 1870, Jl. de Conchyl., **18**, p. 41 (Brazil: description of a shell from Rio de Janeiro; also refers to it *B. cantagallanus* Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 365, the description only); 1872, Moluscos del Viaje al Pacífico, **1**, p. 49; Pl. 4, fig. 1 (type); Pl. 5, fig. 1 (type). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 211. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 62 and 88. Azpeitia Moros, 1923, Rev. Ac. Cienc. Madrid, **21**, pt. 1, p. 73.

Bulimus (*Borus*) *gummatus* Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), p. 195.

Strophocheilus (*Borus*) *gummatus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 23; Pl. 11, figs. 57–58 (after Hidalgo); Pl. 19, fig. 40 (specimen); Pl. 20, fig. 41 (specimen); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus cantagallanus Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 365 (in part: the description of a specimen from Brazil, not the references); 1868, *Op. cit.*, **6**, p. 10 (in part); 1876, *Op. cit.*, **8**, p. 12 (in part). Not of Rang, 1831.

Hidalgo's types should be at the Madrid Museum.

Specimens Examined. BRAZIL: Several without more definite locality (M.C.Z.; Ac.N.S.Phila.; U.S.N.M.; M.N.H.Chic.; A.M.N.H.). Rio Gregugy, Est. Bahia (H. M. Curran.–U.S.N.M.). Cabo Frio, Est. Rio de Janeiro (Rose and Russell.–U.S.N.M.). Rio de Janeiro (D. Bourget.–M.C.Z.). Corcovado near Rio de Janeiro (Hassler.–M.C.Z.; M.U.Mich.). Mt. Mantiqueira near Rio de Janeiro (Ralph Humes Collection).

While *gummatus* is as a rule readily separated from the common form of *S. terrestris* (= *cantagallanus* Rang) by the characters given by Hidalgo, the relations between the two are so close, that they seem best expressed by subordinating *gummatus* as a subspecies to *terrestris*. The general shape varies considerably, but the sculpture of the nepionic whorls is identical in both forms. The shell of *gummatus* is larger, hence appears to be more capacious, although the proportions are exactly those of the broadest specimens of true *terrestris*. Perhaps the most reliable distinguishing feature of *gummatus* is the absence of the whitish subsutural band, a type of character to which I attach little importance. If, however, this is used as a criterion, one finds that in some shells, which in size and sculpture are clearly typical *terrestris*, the subsutural band tends to disappear even on the early whorls, while it is often lacking on the latter part of the body-whorl. On the other hand, I have seen one specimen which on the basis of size, coarseness of sculpture, and strongly reflexed outer lip must be placed with *gummatus*, yet has a distinct pale subsutural band on the early whorls. Moreover, the absence of a subsutural band in most *gummatus* seems to be due primarily to a generalized fading of most of the nepionic whorls.

Turning now to the other characters mentioned by Hidalgo, the stronger spiral threads and malleation of the body-whorl are exceedingly variable, both in the small typical *terrestris* (with subsutural band) and the large *gummatus* (without subsutural band) I have examined. It would be difficult to sort the specimens on the basis of this character alone, as some of the largest typical *terrestris* have about the sculpture of the smallest *gummatus*. The same remark applies to the development of the outer lip, which tends to be wider and more reflexed in most *gummatus* than in the average typical *terrestris*. In old age, the lip is sometimes accrescent behind the rim (in one shell 8 mm. wide), while the hump on the upper portion of the parietal wall may be raised as a crest.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
131 mm.	81	65.5	72	37.5	5¾	Brazil
120	71	61	73	32.5	5½	Corcovado
119	77	64	69	39	5¾	Rio Gregugy
117.5	71	61.5	72	31.5	5½	Corcovado
116	69	57.5	68	33	5½	"
115.5	72.5	59	71.5	32.5	5½	"
112	65	55.5	67	31	5½	Rio de Janeiro
109	65	55	68	29.5	5½	Corcovado
108	69	55.5	67.5	32.5	5½	Brazil

The average length of these specimens is 116 mm., so that Hidalgo's type was actually one of the smaller specimens of this race.

The subsp. *gummatus* may be a case of gigantism, appearing in certain sections of the general area occupied by typical *terrestris*. Unfortunately too little is known at present of the distribution and ecology of these snails to venture more than a hypothesis. Often *gummatus* is very similar in shape to *S. maximus*, for which it may be mistaken, but the peculiar microscopic wavy wrinkling of the periostracum separates it readily from that species.

Hidalgo originally (1870) gave no measurements of his *gummatus*. Later (1872) he gave for the type: "Long. 105, diam. 56 mm."; the diameter measured seems to have been the width in profile.

d. S. TERRESTRIS OLIVEIRAI, new subspecies

Pl. 5, fig. 2

Shell medium-sized (70 mm. long), thick, heavy, slightly translucent, broadly ovate in outline, widest at about the lower third; spire short, much more tapering than base, with moderately convex whorls; summit bluntly pointed, first nepionic whorl flattened. Body-whorl strongly swollen, obese, much more convex than penultimate whorl, its left base slightly saccate, its suture both in front and back view not more oblique than the one above it. Nepionic shell of about 3⅓ whorls, the first and early part of the second smooth; next appear broad, low vertical riblets, at first rather close-set and only slightly narrower than their intervals, gradually more spaced while tending to spread apart or fade away toward the lower suture, somewhat oblique and slightly wavy, only faintly marked beyond the third whorl. Vertical sculpture of post-nepionic whorls of very fine growth-striae and a few weak folds below the suture; body-whorl with traces of malleation. Granulose microsculpture mostly worn off, although traces of granules in spiral rows, similar to those of *S. terrestris*, are to be seen on the third and fourth whorls, as well as below the suture on the early portion of the body-whorl. Aperture pear-shaped in outline, with much thickened peristome, showing old age. Outer lip strongly and evenly convex, slightly expanded, the rim thickened and moderately accrescent (3.5 mm. wide in profile). Columella thickened, rather narrow, strongly and evenly arched, gradually curved into the base of the outer lip. Umbilical slit very narrow, nearly closed. Parietal wall much thickened and raised above the surface of the body-whorl, with an upper hump a short distance from the junction of the outer lip. Periostracum lost. Color uniformly white, owing to the subfossil condition of the shell.

Specimen Examined. Brazil: Propriá, Estado de Sergipe, holotype; found subfossil in the old burying ground known as "Morro dos Chaves" (P. E. de Oliveira.-M.C.Z. No. 175321).

Although agreeing in the sculpture and the saccate base of the body-whorl with *S. terrestris*, the general outline, with the more conical spire, and the relatively short aperture are distinctive.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
70.5 mm.	46	36.5	40	20	5½	Holotype

Strophocheilus (? Megalobulimus) hector (Pfeiffer)

Bulimus hector Pfeiffer, 1857, Malak. Blätt., **4**, p. 157 (Brazil); 1859, Monogr. Helic. Viv., **4**, p. 367; 1868, *Op. cit.*, **6**, p. 11; 1876, *Op. cit.*, **8**, p. 15; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 212.

Bulimus (Borus) hector v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 21. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (Thaumastus) hector Pilsbry, 1895, Man. of Conch., (2), **10**, p. 50.

Thaumastus hector Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. xxi.

This unfigured species, collected by Miers in Brazil, was described from the Cuming Collection, the type being now at the BritishMuseum (M. Connolly, *in litt.*, 1946). I have not recognized it in my material and I am inclined to exclude it from the Strophocheilidae. v. Martens (1876) suggested that it was related to *S. oblongus*; but Pilsbry doubts the generic reference to *Strophocheilus* and places it in*Thaumastus*, which is more probably correct in view of the statement regarding the sculpture of the early whorls ("conferte capillaceo-striati").

For the convenience of future students a copy of the original description follows: "T. subimperforata, elongato-ovata, solidula, sub epidermide decidua, fulvida alba; spira conica, apice rotundata; anfr. 6 convexiusculi, summi conferte capillaceo striati, ultimus spiram vix superans, plicato-striatus et obsolete decussatus; columella leviter arcuata, non plicata; apertura subverticalis, acuminato-ovalis, intus albida, nitida; perist. album, marginibus callo albo junctis, dextro subincrassato, brevissime expanso, columellari superne dilatato, adnato. — Long. 71, diam. 35 mill. Ap. 36 mill. longa, 19½ lata."

STROPHOCHEILUS (MEGALOBULIMUS) HAUTHALI H. von Ihering

Strophocheilus (*Borus*) *hauthali* H. v. Ihering, 1904, Rev. Mus. La Plata, **11**, p. 240; Pl. 2, fig. 20 (Argentina: Cañadón Blanco between the Senguerr and Chubut Rivers; fossil in Lower Tertiary deposits; refers also doubtfully to this species fossils from Colhué-Huapí); 1907, An. Mus. Nac. Buenos Aires, (3), **7**, pp. 460 and 463; 1914, Notas Preliminares Rev. Mus. Paulista, **1**, No. 3, p. 70.

Strophocheilus hauthali Ameghino, 1906, An. Mus. Nac. Buenos Aires, (3), **8**, p. 83.

Tylotoma sp. Roth, 1899, Rev. Mus. La Plata, **9**, p. 382 (according to H. v. Ihering).

Strophocheilos sp. Ameghino, 1902, An. Soc. Cientif. Argentina, **54**, p. 312; 1906, An. Mus. Nac. Buenos Aires, (3), **8**, p. 93.

S. hauthali was described from inner casts only, the sculpture being unknown, and was said to belong to the group of *S. maximus* (Sowerby), *S. popelairianus* (Nyst), and *S. huascari* Tschudi. The figure seems to approach most closely my *S. oblongus* subsp. *conicus*.

Original description of *S. hauthali* (Spanish text translated): "*Strophocheilus* testa oblongo-ovata, ventricosa, anfractibus 6 tumidis, subrotundatis; columella subrecta crassiuscula, apertura parviuscula, labro solidulo reflexo, pariete aperturali medio tuberculo calloso magno munito. Length, 98 mm.; greater diameter, 55 mm.; length of aperture, 45 mm., and its width, 28 mm. I regard as typical the specimen No. 336*a*, in which part of the shell is preserved in the columellar region and this part is of special interest because it shows the apertural wall provided in the middle with an obtuse tubercle, a very large callosity 10 to 11 mm. in diameter. The shell consists of six whorls separated by a deep suture and of whose surface nothing remains. Studying, however, the impressions and superficial grooves noted on the last whorls, it appears that the shell was provided with numerous longitudinal riblets. On the first or nepionic whorls no trace of sculpture is to be seen. The outer lip of the aperture is reflexed and thick. On the specimen figured there appears to be an indication of a false umbilicus, due evidently to the imperfect preservation of the shell." v. Ihering later (1907) referred the strata, in which these fossils were found to the Cretaceous (Ameghino's "étage notostylopéen"); but these strata are now generally placed in the Eocene.

STROPHOCHEILUS (MEGALOBULIMUS) CAPILLACEUS (Pfeiffer)

Pl. 14, fig. 5

Bulimus capillaceus Pfeiffer, 1855 (July), Proc. Zool. Soc. London, for 1855, p. 93 ("banks of the River Solimões" [=Upper Amazon, probably in northeastern Peru]). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 26; Pl. 4, figs. 3–3*a* ("Brazil"; erroneous locality). Pfeiffer, 1859, Malak. Blätt., **6**, p. 37; 1859, Monogr. Helic. Viv., 4, p. 367. A. D. Brown, 1861, Cat. Shells Coll., p. 43; 1866, *Op cit.*, 2d Ed., p. 51. Haines, 1868, Cat. Terr. Shells Coll., p. 45. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 12. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 15; 1877, *Op cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 209.

Bulimus (*Borus*) *capillaceus* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 121 (Peru: "Meobamba" = Moyobamba). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119 (Peru: "Meomba" = Moyobamba).

Bulimus (*Borus*) *oblongus* var. *capillaceus* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 19 ("Puerto"); 1885, Conch. Mitth., **2**, pts. 3–4, p. 157 (Peru: Moyobamba, in NE., 870 m.).

Bulimus oblongus var. *capillacea* E. A. Smith, 1894, Proc. Mal. Soc. London, **1**, pt. 3, p. 137 (Peru: Yurimaguas).

Strophocheilus (*Borus*) *capillaceus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 31; Pl. 14, fig. 69 (specimen from Peru: "Miobamba" = Moyobamba); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Borus capillaceus Dall, 1912, Smithson. Miscell. Coll., **59**, No. 14, p. 2 (Peru: Santa Ana, Urubamba Valley, 3,500 ft). Standen, 1917, Jl. of Conchol., **15**, p. 159 (egg). Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (egg).

? *Bulimus rosaceus* Morelet, 1863, Séries Conchyl., **3**, p. 170 (Peru: Huanuco). Not of King and Broderip, 1832.

The unfigured type of *capillaceus*, from the Cuming Collection, is now at the British Museum (M. Connolly, *in litt.*, 1946).

Specimens Examined. PERU: Near Santa Ana, Río Urubamba, 3,500 ft. (H. Bingham. — U.S.N.M.; W. Weyrauch. — M.C.Z.; O. F. Cook. — U.S.N.M.). Moyobamba (Ac.N.S.Phila.). Ambo near Huanuco, 2,000 m. (W. Weyrauch. — M.C.Z.). Solimões, Upper Amazon River (from Evezard Collection. — U.S.N.M.). — BOLIVIA: Bella Vista, Yungas (M.C.Z.). Espia (W. M. Mann. — U.S.N.M.). — Also some specimens without definite locality (M.U.Mich.) or labelled "Brazil" (U.S.N.M.) or "Eastern Peru (A.M.N.H.).

The specimens recorded as *capillaceus* from Bahia by A. Weber (1925) were no doubt misidentified. I have listed his reference tentatively under *S. oblongus.*

S. capillaceus is medium-sized (58 to 77 mm. long), light, nearly opaque, broadly elliptical to spindle-shaped in outline, widest about mid-length. Spire very short, with shallow sutures, no more tapering than base; summit very blunt, broadly rounded off, the first one and a half nepionic whorls flattened. Body-whorl moderately and evenly swollen, not saccate at the left base, its suture from the back slightly more oblique than the one above it. First and early part of second nepionic whorl smooth; then appear narrow, very regular, nearly parallel, slightly slanting and curved riblets, continuous from suture to suture, about as wide as their intervals below the suture; the riblets extend, though weaker and irregular, over the postnepionic whorls to the outer lip. Granulation excessively fine and often difficult to see even on the nepionic shell; later whorls seemingly without microsculpture. No or very weak malleation. Aperture semi-elliptical, rather narrow, strongly oblique, with the end of the columella much to the left of the vertical axis of the shell. Parietal wall moderately calloused, not humped. Columella narrow and moderately thickened, nearly straight, curving evenly into the base of the outer lip. Umbilical slit very narrow or almost completely closed. Outer lip moderately and evenly arched, slightly expanded and thickened, the rim somewhat reflexed and little or not accrescent in old age (up to 2.5 mm. wide behind the rim). Periostracum lost in all specimens seen, except for an occasional patch, which is yellowish-brown; denuded shell very pale pinkish-yellow, usually whitish below the suture of the body-whorl. Parietal wall, columella and outer lip bright rose.

According to Standen (1917), the egg is pure white, oblong-oval, 15 by 12 mm.

Although *S. capillaceus* has often been confused with small specimens of *S. oblongus*, particularly of the subsp. *musculus*, being misidentified in many collections, it is nevertheless a distinct species, probably restricted to Peru and Bolivia. Its most reliable characteristic, pointed out by T. D. A. Cockerell (1926, The Nautilus, 39, p. 78), is the nepionic sculpture of regular, fine and crowded riblets, similar to that of *S. intertextus,* and more crowded and finer than in any of the races of *oblongus*. In addition, the shell is ventricose-elliptical rather than ovate in outline, the upper half only slightly more narrowed than the lower half; the summit is very obtuse, with the first nepionic whorl depressed and scarcely visible in front view. The granulation is much finer than in S. *oblongus* and no traces of it are visible on the body-whorl even in the best preserved shells seen. The aperture is more oblique than in *oblongus*. Adult shells have about one whorl less than most races of *oblongus*, except subsp. *lorentzianus* and subsp. *musculus*.

Morelet's supposed *rosaceus*, from Huanuco, is here tentatively referred to *capillaceus;* but it might equally well have been S. *separabilis*. Only an examination of the specimen possibly now at the Geneva Museum, could settle the matter. It is certainly not S. *rosaceus* (King and Broderip), of Chile, which I have never seen with a pink peristome. Morelet stated that the shell was 63 mm. long and 30 mm. wide, the periostracum with a violaceous tinge, verging on lilac, the aperture margined with bright pink and brownish-fulvous inside. These features agree well with specimens of *capillaceus* and *separabilis* I have seen from near Huanuco.[1]

Pfeiffer's original measurements of *capillaceus* were: length, 64 mm.; diameter, 37 mm. v. Martens' (1876) specimens varied in length from 63 to 77 mm. and in width from 37 to 47 mm.; but it is not certain that they were all true *capillaceus*. Pilsbry gave the following measurements for two specimens (in mm.): length, 58 and 61; diameter, 38 and 36; length of aperture, 35 and 35. Hupé's specimen of *capillaceus* was 60 mm. long and 38 mm. wide; his figure is very typical, although he gives an erroneous locality.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
73 mm.	45	38	44	21.5	5½	Espia
70	46	35	42	20.5	5⅓	Bella Vista
67	42	35	39.5	19.5	5⅓	" "
67	38.5	32.5	41	17.5	5⅓	Ambo
66	42.5	34	39	19	5⅓	Bella Vista
65	39	33	40	17	5⅓	Santa Ana
65	36.5	34	40	17.5	5⅓	" "
63	37	34	39	18	5¼	" "
61.5	36.5	34.5	40.5	18	5⅕	No locality
60	40	35	40	19	4¾	Moyobamba
58	37	33.5	38	19	4¾	Solimões

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[1] According to information recently received from Dr. G. Mermod (*in litt.*, 1947), there are now in the Angrand Collection, at the Geneva Museum, two specimens labelled *rosaceus*, from Valparaiso, not Huanuco. They are, however, much smaller than indicated by Morelet, one being 51 mm. long; both, moreover have the aperture, including the labrum, white. These specimens are evidently true S. *rosaceus*. Neither of them could be the specimen mentioned by Morelet, the whereabouts of which has not yet been traced.

STROPHOCHEILUS (MEGALOBULIMUS) SEPARABILIS Fulton

Pl. 3, fig. 4; Pl. 9, fig. 1; Pl. 17, fig. 1

Strophocheilus (*Borus*) *separabilis* Fulton, 1903, Jl. of Malacology, **10**, pt. 3, p. 100; Pl. 9, fig. 12 (doubtfully from Peru).

Strophocheilus jenksianus Pilsbry, 1940, Notulae Naturae (Ac. Nat. Sci. Phila.), No. 56, p. 2, figs. 1 (holotype and 2 paratypes, the holotype not designated as such. Peru: Huanuco, Upper Huallaga Valley, 6,000 to 6,500 ft.).

The type of *separabilis* is at the British Museum (M. Connolly, *in litt.*, 1946). The type and paratypes of *jenksianus* are at Ac.N.S.-Phila. (No. 175769), where I have seen them; none of them is marked as holotype.

Specimens Examined. PERU: Huanuco (type and paratypes of *jenksianus*, at Ac.N.S.Phila.; paratype at M.C.Z.; fresh specimens from W. Weyrauch at M.C.Z.). Tomaiquichua, 2,100 m., and Ambo, 2,000 m., both near Huanuco (W. Weyrauch.—M.C.Z.; M.U. Mich.).

I am unable to see how *jenksianus* is to be distinguished from *separabilis*, with which Pilsbry did not compare his species.

Shell medium-sized (58 to 68 mm. long), light, somewhat translucent, moderately thick, solid, elongate-elliptical or almost spindle-shaped, slightly flattened dorso-ventrally, widest about mid-length; summit no more tapering than left side of base in front view; spire about one-sixth of total length, with very obtuse, rounded summit; first nepionic whorl depressed. All whorls flattened-convex, with impressed sutures; body-whorl not ventricose, not saccate at base, its suture in back view scarcely more oblique than the preceding one; penultimate whorl very high and narrow. First nepionic whorl smooth; second and part of third with crowded, fine, regular, slightly slanting, vertical riblets, running from suture to suture, a little narrower than their intervals and scarcely spreading apart, apparently not cut by spiral lines; on the last part of the third whorl the riblets fade rapidly; penultimate and body-whorl with only superficial growth-wrinkles, more or less malleated, sometimes rather coarsely. Granulose microsculpture extremely fine and readily worn off on the nepionic whorls; on young or very fresh adult shells, the penultimate whorl shows a few extremely minute granules, placed in spiral rows, particularly below the suture; granulation almost lacking on body-whorl. Aperture slightly over half the total length, semi-elliptical, its longer axis oblique; base of columella well to the left of vertical axis of shell. Columella thin, narrow, with the barest indication of an entering upper fold, its inner edge evenly arched and gradually curved into the base of the outer lip. Parietal wall weakly calloused, without upper swelling. Outer lip very little expanded, slightly thickened, the rim simple, not accrescent, very narrowly reflexed. Umbilical slit closed. Periostracum readily lost even in life; in the freshest shells seen it is yellowish-brown or pale chestnut; beneath it the shell is drab-brown, darker and more purplish-brown on the nepionic and first portion of the penultimate whorls, with an indefinite dirty-white subsutural band. Aperture vinaceous-brown within. Columella and outer lip coral-pink.

S. separabilis is extremely close to *S. capillaceus*, from which it differs mainly in the more slender, more narrowly spindle-shaped outline, the much higher and narrower penultimate whorl, and the extremely weak vertical sculpture of the last whorls, which are more or less malleated. The differences from *S. carrikeri* are discussed under that species.

Fulton gives the measurements of his *S. separabilis* as: "Maj. diam. 36; alt. 63 mm."; his figure is said to be ⅔ of natural size; this would make the aperture 37.5 by 18 mm. Pilsbry gives measurements of four specimens in the type lot of his *jenksianus* (including the holotype, not designated as such) respectively as follows: length, 61.5, 63, 61, and 68 mm.; diameter, 35.5, 36.5, 37, and 37.5 mm.; length of aperture, 37, 41.5, 36.7, and 38.3 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
71 mm.	40	34.5	43.5	21	5	Tomaiquichua
67	34	28	37	19	5	Huanuco
66.5	36	30	39.5	19	5	Ambo
65.5	34.5	31	41	17.5	5	Huanuco, paratype of *jenksianus*
63.5	34	30	38.5	17	5	Ambo
58.5	31.5	27.5	36	18	5	"

STROPHOCHEILUS (MEGALOBULIMUS) CARRIKERI Pilsbry

Pl. 2, fig. 6; Pl. 6, fig. 4; Pl. 7, fig. 3; Pl. 30, fig. 2

Strophocheilus (*Megalobulimus*) *carrikeri* Pilsbry, 1930, Proc. Ac. Nat. Sci. Philadelphia, **82**, p. 355; Pl. 31, figs. 2–3 (Peru: Huacapistana, Prov. Junin, 6,000 to 7,000 ft.).

The holotype and paratype are at Ac.N.S.Phila. (No. 151811), where I have seen them.

Specimens Examined. PERU: Chilpes, 56 miles N.E. of Tarma, 6,000 ft., several adult shells (J. A. Griswold, Jr. — M.C.Z.; M.U.-Mich.). Huacapistana, Dept. Junin, 1,800 m., several adult and two young shells (W. Weyrauch. — M.C.Z.); also holotype and paratype (M.A. Carriker. — Ac.N.S.Phila.). Pan de Azúcar near Tarma, 1,600 m., one young shell (W. Weyrauch. — M.C.Z.).

S. carrikeri is medium-sized (65 to 82 mm. long), light, moderately thick, solid, almost opaque. Shell elongate-elliptical, slightly flattened dorso-ventrally, widest about mid-length. Spire not more tapering than left side of base in front view, about one-sixth of total length, with bluntly pointed summit; first nepionic whorl depressed. Early whorls flattened-convex, with shallow sutures; body-whorl more ventricose, not saccate at base, with a deep upper suture, which in back view is more oblique than the preceding suture; penultimate whorl relatively high and narrow. First one and a half nepionic whorls smooth; second and most of third with crowded, fine, regular, slightly slanting riblets, running from suture to suture, slightly wider than their intervals and scarcely spreading apart; riblets superficially cut by a few, widely spaced impressed spiral lines; remainder of shell with close-set, irregular growth-wrinkles, more pronounced below the suture; body-whorl and last half of penultimate whorl strongly malleated. Granulose microsculpture poorly developed, even on the nepionic whorls of very young shells; granules minute, best seen on the third and fourth whorls, where they are placed in spiral rows; no trace of them on body-whorl. Aperture over half the total length, pear-shaped, its longer axis oblique; base of columella well to the left of vertical axis of shell. Columella at first thin, later much thickened, with a narrow and slightly twisted upper fold, its inner edge evenly arched and gradually curved into the base of outer lip. Parietal wall moderately calloused, without upper swelling. Outer lip strongly expanded, at first rather thin, gradually thickened with age and sometimes moderately accrescent (rim in one shell 4 mm. wide); outer margin of rim usually sharp and slightly recurved. Umbilical slit closed. Periostracum yellowish-brown with a few darker vertical streaks (in one shell with spiral paler streaks over the last third of the body-whorl); older shells, with worn surface, are dull purplish-vinaceous, sometimes paler below the suture. Aperture pale vinaceous within. Parietal wall, columella and outer lip white.

S. carrikeri belongs to a group of elongate-elliptical or spindle-shaped species, with crowded riblets of the nepionic shell, containing also *S. capillaceus* and *S. separabilis* (= *jenksianus*). From *capillaceus* it may be separated by the more raised spire, the more pointed summit, the high and relatively narrow penultimate whorl, and the coarsely malleated body-whorl. In most of these characters it agrees with *separabilis;* but it is larger, more obese, with a more pointed summit, with a thicker and more expanded outer lip, the rim of which is strongly reflexed, and with a white peristome. The embryonic sculpture is very similar in *separabilis* and *carrikeri*, the latter being perhaps only subspecifically distinct.

Pilsbry's holotype measured: length, 82 mm.; diameter, 45 mm.; length of aperture with peristome, 48.5 mm.; on his figure the aperture is 18.5 mm. wide inside the rim. All other specimens I have seen are slightly smaller.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
77 mm.	41	34	45.5	20	5⅓	Huacapistana
76.5	44	36	48	21	5⅓	"
76	44	37.5	47	22	5⅓	Chilpes
74	42	35.5	47	20	5⅓	Huacapistana
72	42.5	36	45.5	20	5⅓	Chilpes
70	40	34	44.5	20	5⅓	"
64.5	36	36	43	21.5	4¾	"

The smallest specimen seen appears to have formed the outer lip prematurely, as it has about one whorl less than usual and is, moreover, not flattened dorso-ventrally.

Strophocheilus (Megalobulimus) cocapatensis (Pfeiffer)

Bulimus cocapatensis Pfeiffer, 1855 (August), Proc. Zool. Soc. London, for 1855, p. 115 (Bolivia: Cocapata); 1859, Monogr. Helic. Viv., **4**, p. 367; 1868, *Op. cit.*, **6**, p. 11; 1876, *op cit.*, **8**, p. 15. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 209.

Bulimus (*Borus*) *cocapatensis* Pfeiffer, 1856 (January), Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 9. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *cocapatensis* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 20.

Strophocheilus (*Borus*) *cacopatensis* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 12; 1902, *Op. cit.*, (2), **14**, Classification, p. v (misspelling of *cocapatensis*).

Bulimus corapatensis Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 10 (misspelling of *cocapatensis*).

Strophocheilus cocopatensis Pilsbry, 1930, Proc. Ac. Nat. Sci. Philadelphia, **82**, p. 355 (misspelling of *cocapatensis*).

B. cocapatensis, an unfigured species, was described from the Cuming Collection, the type being now at the British Museum. (M. Connolly, *in litt.*, 1946). It was collected by Bridges and evidently part of the same lot from Cocapata which Reeve referred to a large form of *B. rosaceus* in 1848.

S. cocapatensis is unknown to me. Although Pfeiffer compared it with *S. rosaceus*, probably owing to the relatively small size, it does not appear to be related to that species. The radially ribbed and minutely granulated nepionic whorls, mentioned in the description, are not found in *Chiliborus*, but are characteristic of *Megalobulimus*. Pfeiffer (1856) later placed it between "*S. matthewsi*" (= *leucostoma*) and *S. capillaceus*, but, as he does not mark it as being in his collection, this allocation is perhaps of little value. In the description of his *S. carrikeri*, Pilsbry (1930) states that *cocapatensis* is a more elongate shell than *carrikeri*, with narrower lip and much coarser sculpture of the nepionic whorls. He evidently infers that the two species are related. It is not impossible that *cocapatensis* might be the same as *S. intertextus* Pilsbry.

Original description of *B. cocapatensis:* "B. testa imperforata, ovato-oblonga, solida, minutissime decussata, sub epidermide virentifulvida violaceo-carnea; spira convexo-conica, apice obtusa; sutura albida, irregulari; anfr. 5½, superis radiatim costatis et minutissime granulatis, sequentibus peroblique descendentibus, parum convexis, ultimo spiram subaequante, basi rotundato; columella recedente, leviter arcuata; apertura subverticali, acuminato-ovali, intus margaritacea; perist. incrassato, breviter expanso, marginibus callo nitido junctis, columellari dilatato, adnato. Long. 67, diam. 30 mill."

STROPHOCHEILUS (MEGALOBULIMUS) LEUCOSTOMA (Sowerby)

a. Typical LEUCOSTOMA

Pl. 7, fig. 2; Pl. 10, figs. 1, 2; Pl. 12, fig. 3; Pl. 23, fig. 4; Pl. 31, fig. 2

Bulinus leucostoma Sowerby, 1835 (April), Proc. Zool. Soc. London, for 1834, p. 141 (Peru: Prov. Xagua).[1] T. Müller, 1836, Synopsis Nov. Test Viv. 1834 Promulg., p. 30.

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[1] The names *Bulinus leucostoma* and *Helix lacunosus* were both published in 1835, but Sowerby's name antedates d'Orbigny's. Page 141 of the Proc. Zool. Soc. London for 1834 appeared April 3, 1835. As d'Orbigny dated his article in No. 61 of the Magasin de Zoologie, July 1, 1835, it could not have been issued before that date. Moreover, *Bulinus leucostoma* is not a homonym of *Bulimus leucostoma* Poiret, 1801, the latter being not now placed in *Strophocheilus*.

Bulimus (*Bulimus*) *leucostoma* Beck, 1837, Index Moll., pt. 1, p. 53.

Bulimus leucostoma Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 156.

Bulimus leucostomus Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 23; 1853, *Op. cit.*, **3**, p. 304. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 27. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366; 1868, *Op. cit.*, **6**, p. 11 (Peru: Valle de Lares); 1868, Novit. Conchol., Abt. I, **3**, pts. 31–32, p. 409; Pl. 94, figs. 1–2; 1876, Malak. Blätt., **23**, p. 199; 1876, Monogr. Helic. Viv., **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 213.

Bulimus (*Borus*) *leucostomus* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Helix (*Cochlogena*) *mathiusii* d'Orbigny, 1835 (after July 1), Mag. Zool., **5**, Class V, No. 61, p. 16 (Peru).

Bulimus mathiusii d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 303; Pl. 36 (37 of Expl. of Plates, p. 695), figs. 3–4 (2 views of type. Eastern slope of Peruvian Andes). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 157.

Strophocheilus (*Borus*) *mathiusii* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 17; Pl. 7, figs. 4–5 (after d'Orbigny); Pl. 9, fig. 45 (specimen); 1902, *Op. cit.*, (2), **14**, Classification, p. v. Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 46.

Borus mathiusii Dall, 1912, Smithson. Misc. Coll., **59**, No. 14, p. 2 (Peru: Santa Ana, Urubamba Valley, 3,500 ft.).

Bulimus (*Bulimus*) *mathewsii* "d'Orbigny" Beck, 1837, Index Moll., pt. 1, p. 53 (emendation of *mathiusii*).

Bulimus matthewsii "d'Orbigny" Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 25 (error for *mathewsii*); 1853, *Op. cit.*, **3**, p. 305. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 27. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366; 1868, *Op. cit.*, **6**, p. 11. Paetel, 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 214.

Bulimus (*Borus*) *matthewsii* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855) p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 7. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Bulimus mathewsi H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146.

Strophocheilus mathieusii "Orb." Pilsbry, 1930, Proc. Ac. Nat. Sci. Philadelphia, **82**, p. 355 (error for *mathiusii*).

Bulinus mahogani Sowerby, 1838 (before October 31), Conchol. Illustr., *Bulinus*, fig. 59 of Pt. 137 (with name in accompanying printed list; no description; no locality; figure of the type of *Bulinus leucostoma* Sowerby, 1835).

Bulimus mahogani Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 157.

Bulimus (*Orphnus*) *mahogani* Albers, 1850, Die Heliceen, p. 146. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 149.

Bulinus magohani "Sowerby" Pfeiffer, 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 254 (as a doubtful synonym of *Bulimus bronni*). Misspelling of *mahogani*.

Bulimus castelnaudi Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 27; Pl. 4, figs. 2–2*a* (Peru). Pfeiffer, 1858, Malak. Blätt., **5**, p. 162; 1859, *Op. cit.*, **6**, p. 36. Not *Bulimus castelneaui* Pfeiffer, 1856.

Bulimus (*Borus*) *castelnaui* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 9 (Peru: Valle de Lares).

Bulimus hupeanus Morelet, 1863 (April), Séries Conchyl., **3**, p. 170 (Peru: Vilcabamba. New name for *B. castelnaudi* Hupé, 1857). Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 11; 1876, *Op. cit.*, **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 212.

Bulimus (*Borus*) *hupeanus* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *hupeanus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 19; Pl. 8, fig. 40 (after Hupé); Pl. 9, fig. 44 (after Pfeiffer); Pl. 15, fig. 23 (after Pfeiffer); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus dürfeldti H. Dohrn, 1863 (August), Malak. Blätt., **10**, p. 152 (Peru: Cuzco). Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 11; 1876, *Op. cit.*, **8**, p. 15; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p 210.

Bulimus (*Borus*) *dürfeldti* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 8; Pl. 140, figs. 4–5 (one of 2 cotypes). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *durfeldti* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 18; Pl. 10, figs. 51–52 (after v. Martens); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus lacunosus Blume, 1920, Arch. f. Molluskenk., **52**, p. 129 (Peru: Vilcanota; with form *sinistralis*).[1] Not of d'Orbigny, 1835.

The type of *mathiusii* is at the British Museum, but not that of *leucostoma* (= *mahogani*). (M. Connolly, *in litt.*, 1946).[2] That of *castelnaudi* Hupé (= *hupeanus*) is at the Paris Museum (E. Fischer, *in litt.*, 1947) and is shown on Pl. 31, fig. 2, after a photograph sent by Dr. Fischer. The two cotypes of *dürfeldti*, originally in the Dohrn Collection, may be in Stettin.

From a study of the published descriptions and figures, as well as of specimens, I conclude that the names *leucostoma*, *mathiusii*, *mahog-*

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[1] Blume's reference is here placed under typical *leucostoma* on the strength of two shells from Vilcanota at M. U. Mich. (bought from H. Rolle) and U. S. N. M. (bought from Fulton), one of them figured on Pl. 7, fig. 2. They are clearly narrow specimens of *leucostoma* and not shaped like true *lacunosus*, which is shown on Pl. 13, fig. 5.

[2] The types of *leucostoma* and *mathiusii* were originally part of the same lot, collected by one Mr. Mathews. d'Orbigny's "Mathius" is merely the French phonetic rendering of the name.

ani, castelnaudi, hupeanus, and *dürfeldti* were all based on individual variants of one form. None of these names seems to apply to the somewhat similar *S. separabilis* (=*jenksianus*). Sowerby's figure of *mahogani* (type of *leucostoma*) and d'Orbigny's figure of the type of *mathiusii* do not show the very obtuse summit and the peculiar bulging penultimate whorl of *separabilis,* while the peristome is white (in all *separabilis* seen the peristome is violaceous-pink). *B. dürfeldti,* as figured by v. Martens, has the regular fusiform shape and rather narrow summit of d'Orbigny's *mathiusii,* and is minutely granulose over most of the surface. It was apparently based on a better preserved specimen of *S. leucostoma.* The published figures of *leucostoma* (=*mahogani*) and *hupeanus* (=*castelnaudi*) are not as regularly spindle-shaped in outline as the others; but in a series of specimens from Ambo near Huanuco, some are much like these figures, while others resemble d'Orbigny's figure or are transitional. In any case, neither Sowerby's nor Hupé's figures fit *S. separabilis.*

Specimens Examined. Peru: San Miguel, Urubamba Valley (O. F. Cook — U.S.N.M.). Santa Ana, Urubamba Valley, 3,500 ft. (H. Bingham. — U.S.N.M.). Vilcanota (U.S.N.M., received from Fulton as *hupeanus;* M.U. Mich., received from Rolle as *lacunosus*). Ambo near Huanuco, 2,000 m. (W. Weyrauch. — M.C.Z.; M.U. Mich.) Río Callanga (M.U.Mich., received from Fulton as *dürfeldti*). Also several merely labelled "Peru" (M.C.Z.; M.U. Mich.; A.M.N.H.).

The typical form of *S. leucostoma* is medium-sized (63 to 79 mm. long), light, translucent, regularly spindle-shaped in outline, widest about mid-length. Spire relatively short, about one-fifth of the total length, no more tapering than base; summit bluntly pointed, all nepionic whorls distinctly raised above one another. Sutures shallow. Body-whorl moderately and evenly convex, not saccate at base to the left of columella, its suture from the back much more slanting than the one above it; upper terminal portion (close to outer lip) slightly flattened below the suture, but the latter not descending. First nepionic whorl smooth; next whorls with strong, blunt, regular, nearly straight, slightly slanting, continuous, vertical riblets, at first parallel and about as wide at their intervals; later the riblets are somewhat more spaced and spread apart slightly toward the lower suture, which they reach even on the third whorl. Penultimate and body-whorl with light, spaced folds faintly crenulating the upper suture and with weak growth-striae. Microsculpture of the usual fine granulation, well-marked even on the body-whorl where the granules are placed in irregular spiral lines. No malleations. Aperture semi-elliptical, slightly oblique, its basal angle well to the left of vertical axis of shell. Parietal wall as a rule moderately calloused (except in old age), without hump. Columella usually narrow and thin, straight, strongly slanting, evenly curved into the base of the outer lip; its outer edge narrowly reflexed and completely closing the umbilicus. Outer lip as a rule moderately thickened and expanded, the rim equally wide throughout, sometimes slightly accrescent in old age (up to 5 mm. wide). Periostracum dark olivaceous to mahogany-brown, with lighter vertical streaks on the body-whorl. Earlier whorls purplish-brown, often with a dirty yellow subsutural band, rarely continued to the outer lip. Aperture purplish or bluish-white within; columella, outer lip and parietal wall pure white.

Sowerby gave the original measurements of *leucostoma* as 2.6 inches [=65.5 mm.] long and 1.4 inches [=35 mm.] wide. This is about the size of the figure of *mahogani*, which has an aperture of 40 by 17 mm. It is interesting that d'Orbigny gave about the same measurements for the type of *mathiusii:* "Long. 65 mm.; lat. 35 mm."; his figure has the aperture 40 by 17 mm. Hupé's type of *castelnaudi* (=*hupeanus*) is 68 mm. long and 34 mm. wide; on the figure the aperture is 35 by 18 mm. Dohrn gave for the type of *dürfeldti:* length, 70 mm.; width, 30 mm.; aperture, 36 by 23 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
78.5 mm.	43	36.5	45.5	20	5½	San Miguel
72	35	31	39	17	5½	Ambo
71	36.5	32.5	39	18	5½	
69.5	33	28.5	37	17	5½	Vilcanota
68	33	29	36	17	5½	Ambo
66	34	30.5	35	16	5½	"
64	33.5	30	37	18.5	5½	"
63	33	30	34.5	15.5	5½	Santa Ana
60.5	33	30	34.5	17	5½	Ambo

b. S. LEUCOSTOMA LACUNOSUS (d'Orbigny)

Pl. 13, fig. 5; Pl. 15, fig. 3

Helix (*Cochlogena*) *lacunosus* d'Orbigny, 1835 (after July 1), Mag. Zool., 5, Class V, No. 61, p. 15 (Bolivia: Tutulima, Prov. Cochabamba).

Bulimus (*Bulimus*) *lacunosus* Beck, 1837, Index Moll., pt. 1, p. 52.

Bulimus lacunosus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 302; Pl. 36 (37 of Expl. of Plates, p. 695), fig. 5–6 (2 views of type. Bolivia: north of the hamlet Tutulima, at the foot of the Cordillera de Cochabamba, between the city of Cochabamba and the Prov. Moxos). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 156. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 28; 1853, *Op. cit.*, **3**, p. 306. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Pfeiffer, 1859, Malak. Blätt., **6**, p. 37; 1859, Monogr. Helic. Viv., **4**, p 369; 1868, *Op. cit.*, **6**, p. 13; 1876, *Op. cit.*, **8**, p. 21; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 213.

Bulimus (*Borus*) *lacunosus* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 148. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 7. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *lacunosus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 17; Pl. 6, figs. 31–32 (after d'Orbigny); 1902, *Op. cit.*, (2), **14**, Classification, p. v. Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 46.

Bulimus (*Borus*) *lacunarum* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 7 (suggested emendation of *lacunosus*).

Bulimus santa-cruzii Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 11 (in part: specimen from Peru: Prov. Carabaya, collected by Raimondi). Not *Helix santa-cruzii* d'Orbigny, 1835.

Bulimus santacruzensis Pfeiffer, 1868, Novit. Conchol., Abt. I, **3**, pts. 31–32, p. 416 (in part: not the description); Pl. 95, figs. 1–2 (specimen figured from Peru: Prov. Carabaya).

Bulimus (*Borus*) *sanctae-crucis* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 6 (description based on a specimen from Peru: Prov. Carabaya). Not of v. Martens, 1867.

Strophocheilus (*Borus*) *santacruzii* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 16 (part of references and description based on a specimen from northern Peru); Pl. 4, fig. 3 (after Pfeiffer).

Strophocheilus (*Borus*) *rugosus* Fulton, 1905, Jl. of Malacology, **12**, p. 23 (new name for *B. santacruzensis* Pfeiffer, 1868, and *S. santacruzii* Pilsbry, 1895; with reference to Pfeiffer's Pl. 95, figs. 1–2).

d'Orbigny's holotype of *lacunosus* is at the British Museum (M. Connolly, *in litt.*, 1946). I have seen a probable paratype at U.S.N.M. (No. 104907). Two possible cotypes of Fulton's *rugosus* ("*ex auct.*") are in Mr. J. R. leB. Tomlin's collection, according to Major Connolly.

Specimens Examined. PERU: Carabaya (M.C.Z.). Three specimens from "northern Peru", without more definite locality (Ac.N.S.-Phila.). — BOLIVIA: one specimen without more definite locality, probably a cotype or paratype of *lacunosus* (from an old collection. — U.S.N.M.; the old label is written in the same hand as that of the cotype of *B. santa-cruzii* mentioned under that species).

Fulton does not figure his *rugosus*, but refers to it Pfeiffer's figures of 1868 of *santacruzensis* (emendation of *santa-cruzii*). It will be necessary to quote his remarks in full:

"*Strophocheilus santacruzi* Orbigny, of which I have seen type in the Orbigny collection, and also a co-type from the Morelet collection (ex Paris Museum), is quite distinct from the specimens identified as that species by Pfeiffer and Pilsbry. — *S. santacruzi* Orb., described in the "Mag. de Zool.," 1835. Moll., p. 15, and figured in the "Voyage dans l'Amérique méridionale" p. 302, t. 38, figs. 1, 2, is a much smoother shell, the two lower nepionic whorls are sculptured with fine close-set raised striae, and the post-nepionic whorls are covered with a fine spiral granulation. — The lower nepionic whorls of *rugosus* have rather distant strong radial riblets, the penultimate whorl is granulated, but the last has no granulation, but strong rugose striae or lines of growth. — Comparatively speaking, *rugosus* is a rough-looking shell, while *santacruzi* is a smooth one."

Although Fulton gives no locality for his *rugosus*, it is clear that he must have seen specimens, as otherwise he could not have described the microsculpture. It should also be noted that Fulton cites Pfeiffer, 1848, Monogr. Helic., vol. **2**, p. 23, by error in the synonymy of his *rugosus*, since Pfeiffer states explicitly that his description of 1848 was based on a specimen received by Philippi from d'Orbigny, hence a cotype of *santa-cruzii*. Likewise the description by Pfeiffer, 1868, Novit. Conchol., Abt. I, **3**, pts. 31–32, p. 416, was based on a cotype of *santa-cruzii*, as stated at the beginning of the German and French translations. Moreover, the measurements (length, 92 mm.; diameter, 50 mm.; aperture, 47 by 23 mm.) are those of true *santa-cruzii*, not those of the specimen from Carabaya, shown on Pl. 95, figs. 1–2, which is *rugosus* Fulton. v. Martens' description of *sanctae-crucis* in 1876, being based on a specimen from the same Carabaya lot, collected by Raimondi, clearly refers also to *rugosus*, not to the true *santa-cruzii*.

Both *lacunosus* and *rugosus* remained puzzling to me, until I saw the specimen, labelled "*lacunosus*" at the U.S.N.M., which I regard as one of d'Orbigny's cotypes. It agrees well with the original description and figures, but is slightly shorter and broader. It lacks the periostracum, hence shows only traces of the granulation. In shape it is transitional between d'Orbigny's figure and the figure by Pfeiffer (1868) which Fulton refers to his *rugosus*. This leads me to synonymize *rugosus* with *lacunosus*. The specimen from Carabaya is fresh and covered with the periostracum. In outline it is like d'Orbigny's figure, but is slightly smaller and narrower. The body-whorl at first appears to be without granulation; but a careful study with the lens discloses a few, scattered, minute granules.

The vertical stripes so beautifully shown in d'Orbigny's figures are not of color, but are broad, shallow furrows caused by growth. In the supposed cotype seen they are much less regular and more spaced than in the figure, which I suspect was somewhat improved by the artist's fancy. They are best seen when the shell is held with the summit down, as in d'Orbigny's figure.

A comparison of the few specimens seen and of d'Orbigny's and Pfeiffer's (1868) figures with several lots of typical *leucostoma* forces me to the conclusion that *lacunosus* is only subspecifically distinct. Its chief peculiarity is the narrower, lengthened spire, which is nearly one-fourth of the total length of the shell and is more pointed than in typical *leucostoma.* As a result, the outline is not regularly spindle-shaped, the shell being widest slightly below the middle. In addition, the granulose microsculpture is everywhere much less developed and even obsolete on the body-whorl. In the fresh specimen from Carabaya, the outer lip is moderately thickened, but in the supposed paratype it is decidedly accrescent (4 mm. wide behind the rim), as shown in d'Orbigny's figure. Possibly *lacunosus* averages larger than typical *leucostoma,* the few known specimens being 80 to 90 mm. long.

The relations between *lacunosus* and the true *S. santa-cruzii* are discussed under the latter.

The original measurements of d'Orbigny's *lacunosus* were: "Long. 90 mm.; lat., 43 mm."; but his figure 6 is slightly smaller: 87 mm. long; 40 mm. wide; the aperture 47 by 17 mm. Pfeiffer's figure of 1868, referred by Fulton to his *rugosus,* measures (in mm.): length, 85; greatest width, 43; aperture, 46 by 21. v. Martens gives the measurements of what appears to be the same specimen, in the Dohrn collection,[1] as: length, 86 mm.; width, 44 mm.; aperture, 46 by 21 mm. (width inside the rim).

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
87 mm.	44	38	49	21.5	5¾	Northern Peru
85	41	36	45	18.5	5¾	Bolivia (? cotype)
82.5	41.5	36	49	21	5½	Northern Peru
80	36	33.5	40.5	18	5¾	Carabaya

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[1] Pfeiffer's collection was acquired by Dohrn.

STROPHOCHEILUS (MEGALOBULIMUS) SANTA-CRUZII (d'Orbigny)

Pl. 30, fig. 3

Helix (*Cochlogena*) *santa-cruzii* d'Orbigny, 1835, (after July 1), Mag. Zool., **5**, Class V, No. 61, p. 15 (Bolivia: Province Yungas).

Bulimus santa-cruzii d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 302; Pl. 36 (37 of Expl. of Plates, p. 695), figs. 1–2 (2 views of type. Bolivia: Provinces of Yungas and Ayupaya, on the Rio Tamampaya near Coripata, and at the villages of Carcuata and Suri). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 160. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 23 (description based upon a specimen received by Philippi from d'Orbigny); 1853, *Op. cit.*, **3**, p. 304. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 27. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366; 1868, *Op. cit.*, **6**, p. 11 (in part; not the specimen from Prov. Carabaya, which is *S. leucostoma lacunosus*); 1876, *Op. cit.*, **8**, p. 13; 1877, *Op. cit.*, **8**, p. 604.

Bulimus (*Borus*) *santa-cruzii* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *santacruzii* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 16 (in part: some references only, not the description nor Pl. 4, fig. 3, which are *S. leucostoma lacunosus*); 1902, *Op. cit.*, (2) **14**, Classification, p. v. Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 45.

Bulimus (*Bulimus*) *st.-crucis* Beck, 1837, Index Moll., pt. 1, p. 52 (emendation of *santa-cruzii*).

Bulimus sancta-cruzii H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146 (emendation of *santa-cruzii*).

Bulimus santacruzensis Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 11 (suggested emendation of *B. santa-cruzii*); 1868 (May), Novit. Conchol., Abt. I, 3, pts. 31–32, p. 416 (in part: the description based on a specimen received from d'Orbigny, not the figures). Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 217.

Bulimus lacunosus Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 35, fig. 208. Hupé, 1857, Anim. Nouv. Rares Amér. Sud. de Castelnau, **3**, Moll., p. 27; Pl. 5, figs. 1–1*a* (Bolivia: Province Chuquisaca). Not of d'Orbigny, 1835.

Strophocheilus (*Borus*) *huascari* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 195; Pl. 16, fig. 25 (after Reeve's fig. 208). Not of v. Tschudi, 1852.

d'Orbigny's figured holotype of *santa-cruzii* is at the British Museum (M. Connolly, *in litt.*, 1946). He evidently sent cotypes to various collectors, one being at the Paris Museum (from Morelet's collection, *teste* Fulton) and another being sent to Philippi (present whereabouts unknown). I believe I have located another cotype at the U.S.N.M., as I found inside the shell an old label bearing in red ink, in d'Orbigny's handwriting, the notation "Helix No. 87", which is the serial number of *Helix santa-cruzii* in d'Orbigny's paper of 1835; there is also a label in pencil giving the name *Bulimus santacruzii*, but in a different handwriting. The specimen, moreover, is almost identical with the original figure.

Specimen Examined. BOLIVIA: Apparently a paratype or cotype from the original lot, not labelled with a more definite locality (from an old collection. — U.S.N.M., No. 104908).

A study of this specimen, of d'Orbigny's original account, of Fulton's remarks on his *S. rugosus*, and of a supposed cotype of *lacunosus* (see under *S. leucostoma lacunosus*) has led to the conclusion that *S. santa-cruzii* is very closely related to *S. leucostoma*, but seems to differ in the following particulars. (1) The nepionic riblets, although as well marked as in *leucostoma* and extending from suture to suture, are much less regularly spaced. On the second and beginning of the third whorl they are farther apart, some of them tending to be closer in pairs. On the remainder of the nepionic shell they are finer, more irregular, often with incomplete weaker riblets (starting from the lower suture) in the intervals. (2) The granulose microsculpture is distinct all over, being visible on the body-whorl even after the loss of the periostracum (almost completely worn in the cotype seen). It does not, however, appear to be more developed than in typical *leucostoma*, though it is decidedly stronger than in subsp. *lacunosus*. (3) The outline of the shell is broadly spindle-shaped, with the body-whorl more ventricose than in typical *leucostoma* and the sutures somewhat deeper; these differences are perhaps due mostly to the larger size, *S. santa-cruzii* being considerably longer than the largest known typical *leucostoma*. The subsp. *lacunosus* approaches it in size, but differs in outline, being more slender, with a much narrower spire. I cannot attach much importance to the supposedly smoother surface of *santa-cruzii*. The cotype seen differs scarcely in this respect from typical *leucostoma*. As in the case of *lacunosus*, the vertical stripes of d'Orbigny's figures are not due to color, but to broad shallow furrows, visible when the shell is held against the light with the summit downward; in the figures they appear to be somewhat fanciful.

d'Orbigny gave as original measurements of *santa-cruzii* (in 1835): "Longit. 9 cm.; latit. 5 cm."; but in 1837 he emended these to "Long. 90 mm., lat. 43 mm.," agreeing better with his figures, in which the aperture is 50 by 23 mm. Reeve's figure, which I refer to *santa-cruzii*, is 100 mm. long, 50 mm. wide, the aperture 52.5 by 23.5 mm.; and Hupé's is 97 mm. long, 49 mm. wide, the aperture 47 by 22 mm.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
93 mm.	51.5	45.5	50	23	5½	Bolivia, paratype

It is not impossible that, with more extensive material from the Bolivian Andes and the adjoining section of Peru, *santa-cruzii* will be recognized as a subspecies only of *leucostoma*. For the time being it will be more prudent to retain it as a species.

Some specimens later referred to *santa-cruzii* were clearly misidentified, most of them being *S. leucostoma lacunosus*. On the other hand, I refer to *santa-cruzii* the shell figured by Reeve (1848) as *lacunosus*, since it is much too broad for true *lacunosus*. The specimen was from Cuming's collection, who had received it from d'Orbigny; possibly d'Orbigny sent it with a numbered label similar to the one I found in the U.S.N.M. shell and Cuming made one of his customary errors when he gave it a specific name, adding the locality where the true *lacunosus* had been obtained. In my opinion, Hupé's (1857) figure of "*lacunosus*" is also *santa-cruzii;* it is exceedingly similar to Reeve's figure. Pilsbry referred both these figures to *S. maximus huascari*, but the non-saccate base of the body-whorl and the narrower spire seem to preclude this identification.

STROPHOCHEILUS (MEGALOBULIMUS) SANCTIPAULI H. v. Ihering and Pilsbry

a. Typical SANCTIPAULI

Pl. 13, fig. 7

Strophocheilus oblongus var. *sanctaepauli* H. v. Ihering and Pilsbry, 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 390 (Brazil: Botucatu, Est. São Paulo).

Strophocheilus (*Borus*) *sanctaepauli* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 123; Pl. 20, fig. 63 (type).

Strophocheilus (*Borus*) *sanctipauli* Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. v (author's emendation of *sanctaepauli*).

The holotype is at Ac.N.S.Phila., where I have seen it.

Specimens Examined. BRAZIL: Botucatu, Est. São Paulo, holotype (H. v. Ihering. — Ac.N.S.Phila. No. 71229). Est. São Paulo (M.Z.C. — From Putzeys Collection). Cerqueira César, Est. São Paulo (M.C.Z.). Paranaguá, Est. Paraná (G. B. Fairchild. — M.C.Z.). — PARAGUAY: Puerto Bertoni, Alto Paraná (H. v. Ihering. — U.S.N.M.).

S. sanctipauli agrees in general shape and in most characters with *S. granulosus.* In the few specimens seen (of all races) it differs in the much stronger, more crowded and more regular nepionic riblets, which extend from suture to suture even over the third whorl. Moreover, the post-nepionic whorls also are covered with riblets, becoming irregular over the terminal portion of the body-whorl. On the other hand, the granulation appears to be weaker than in *S. granulosus,* being often lacking over most of the body-whorl (possibly worn). Base of body-whorl not appreciably saccate to left of columella. Peristome rose-colored or pinkish in the typical race.

Pilsbry's measurements of the type are (in mm.): length, 85; diameter, 43; longest axis of aperture, 45; slightly corrected measurements are given below.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
99 mm.	51	46	55	22	6	Puerto Bertoni
98	50.5	46	53	21	6	" "
92.5	50	45.5	56	23	5½	Paranaguá
86	44	38	45	21	5½	Botucatu, holotype
82.5	41	37	44	18.5	5⅛	Est. São Paulo
80	45	39.5	44.5	21	5⅓	Cerqueira César

b. S. SANCTIPAULI PYGMAEUS, new subspecies

Pl. 15, fig. 5

Smaller than typical *sanctipauli,* with relatively shorter and broader spire and broadly rounded summit. Sculpture and color as in typical form, but nepionic riblets much worn. Entire peristome bright pink.

Specimen Examined. BRAZIL: Without more definite locality, holotype (U.S.N.M. No. 522346).

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
62.5 mm.	33	30	34	15	5⅛	Holotype

The specimen was received from Fulton as a dwarfed *S. granulosus,* but it does not have the nepionic sculpture nor the slightly saccate left base of that species.

c. S. SANCTIPAULI EYERDAMI, new subspecies

Pl. 24, fig. 2

Similar in shape of shell and aperture to typical *sanctipauli*, but smaller and with somewhat shorter spire, although not broadly rounded at summit (thus differing from subsp. *pygmaeus*). Nepionic riblets very strong, separated by deep intervals. Granulation well developed, also over body-whorl to near rim of outer lip. Periostracum light olivaceous-yellow, with a few darker streaks; shell beneath it uniformly white. Columella and outer lip white; parietal wall with a thin white glaze.

Specimen Examined. ARGENTINA: Near Tartagal, Prov. Salta, close to the Bolivian border, holotype (W. J. Eyerdam. — M.C.Z. No. 132300); found on the ground in the forest.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
69 mm.	34	32	39.5	17	5¼	Holotype

STROPHOCHEILUS (MEGALOBULIMUS) YPORANGANUS

H. v. Ihering and Pilsbry

a. Typical YPORANGANUS

Pl. 13, fig. 4

Strophocheilus (*Borus*) *yporanganus* H. v. Ihering and Pilsbry, 1901, Man. of Conch., (2), **14**, p. 120; Pl. 19, figs. 56–57 (Brazil: Yporanga, Est. São Paulo); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus yporanganus Clench and Archer, 1930, The Nautilus, **43**, p. 77 (Brazil: Yporanga, São Paulo).

Strophocheilus ovatus subsp. *iguapensis* Maury, 1935, Amer. Mus. Novit., No. 764, p. 12, figs. 12–13 (Brazil: Yporanga, near Ribeira do Iguapé, Est. São Paulo; presumably fossil in the "San Roque Series of metamorphic crystalline limestones," supposedly Pleistocene). Not *Strophocheilus milleri* var. *iguapensis* Pilsbry, 1901.

The type of *yporanganus* is at the Departamento de Zoologia, Secretaria da Agricultura (formerly Museu Paulista), in São Paulo. The figure was made from the type, which was evidently examined by Pilsbry. The description appears to have been written by Pilsbry, although he credits the name to both himself and v. Ihering. The types of *S. ovatus iguapensis* are at A.M.N.H. in New York (No. 24244).

Specimens Examined. BRAZIL: Yporanga, Est. São Paulo, two adult and one young shells (G. Allen. — M.C.Z.). Registro de Iguapé, Est. São Paulo (M.C.Z.).

The late Dr. G. Allen collected his specimens at the entrance of one of the well-known limestone caves of Yporanga, where, as the late Miss Maury states, *Strophocheilus* shells are being buried in great numbers. One of Allen's specimens has a pinkish peristome and certainly is not fossil. Miss Maury established the subsp. *iguapensis* on two fragments; the one figured consists of the apex only and this has the peculiar ribbed sculpture of *yporanganus* (it should be noted that her figure is enlarged two and one-half times). It seems reasonable to surmise that these fragments were not true fossils, but had been buried in the limestone cave deposits within comparatively recent times.

Shell medium-sized (81 to 91 mm. long), moderately thick, solid, almost opaque, elongate-elliptical to spindle-shaped, scarcely more tapering at spire than at the left side of base, moderately flattened dorso-ventrally. Body-whorl slightly more ventricose than penultimate whorl, about four-fifths of the total length in front view, not saccate at base to the left of columella. Spire well-raised; penultimate whorl high and narrow; summit bluntly pointed; all sutures shallow, that of body-whorl in back view much more slanting than the preceding one. First nepionic whorl smooth; then appear rather narrow, prominent, vertical riblets, placed far apart (about 17 or 18 on the second whorl), slanting and slightly curved, spreading much farther apart to the lower suture, which most of them reach on the second and third whorls; on the third whorl the intervals below the suture are about twice the width of a riblet; riblets indicated as weak subsutural folds on penultimate whorl and absent on body-whorl; these last two whorls with fine, crowded, irregular growth-striae. Granulose microsculpture distinct but very fine, in crowded spiral rows, on all whorls except the first, persisting even on the body-whorl of weathered shells. Aperture slightly over half the total length, semi-elliptical, its longer axis oblique, its basal angle well to the left of vertical axis of shell. Columella slightly thickened, with a narrow fold above, its inner edge very slightly concave, evenly curved into the base of outer lip. Parietal wall very little calloused, without upper swelling. Outer lip moderately thickened, very narrowly expanded, equally wide throughout. Umbilical slit completely closed. Periostracum (as seen in a very young shell) very light yellowish-brown; a faint whitish band below suture. Inside of mouth bluish-white. Parietal wall and columella slightly pinkish; outer lip deep rose-color, brighter than columella.

As Pilsbry pointed out, *S. yporanganus* is closely related to *S. granulosus*, from which it differs mainly in the narrower, more prominent and more spaced vertical riblets of the nepionic shell.

The original measurements given for the figured type are (in mm.): length, 91; diameter, 48; longest axis of aperture, 50.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
84 mm.	44.5	38	48	20	5½	Yporanga
81	42.5	36	46	19	5½	"

b. S. YPORANGANUS TORIII (Lange de Morretes)

Pl. 25, fig. 4

Megalobulimus toriii Lange de Morretes, 1937, Rev. Mus. Paulista, **23**, p. 301; Pl. 1, figs. 1–5 (Brazil: Jupuvura, Municipio de Iguapé, Est. São Paulo).

The types were found in subfossil condition at a depth of about one meter in the old Indian kitchen-midden ("Sambaqui") of Morro do Bernardes. The holotype is said to be in the author's collection; but paratypes were deposited at the Departamento de Zoologia, Secretaria da Agricultura (formerly Museu Paulista), in São Paulo, under Nos. 14106, 14107, and 14108. One of these (No. 14107) was very kindly presented to the M.C.Z. by Dr. Oliverio M. de Oliveira Pinto.

Specimen Examined. BRAZIL: Jupuvura, Municipio de Iguapé, Est. São Paulo, paratype (F. Lange de Morretes. — M.C.Z.).

This specimen is unusually well preserved. Although without periostracum, completely chalk-white and with the heavy texture often acquired by subfossil shells, its sculpture is in perfect condition. Very clearly *toriii* is at most a race of *yporanganus*, the nepionic riblets (well shown in Lange de Morretes' fig. 5) and the shape of shell and aperture being the same. From typical *yporanganus* it differs only in the slightly smaller size (68 to 77.5 mm. long) and particularly in the presence of a broad, accrescent outer lip, which is 5 to 8 mm. wide behind the rim.

Measurements of Adult Shell

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
75.5 mm.	41	35	42.5	19	5⅔	Jupuvura, paratype

Original description of *S. toriii* ((translated): "Shell solid, dorso-ventrally compressed; five and two-thirds whorls, provided (except on the smooth first and next half whorls) with a fine granulation which disappears on the last whorl; three and a half nepionic whorls (except for the smooth portion) bearing riblets progressively more spaced, only decreasing a little before the end; two and one-sixth post-nepionic whorls with weak lines of growth, accentuated however at the suture, to which they give some irregularity; peristome thick, salient on the parietal portion, nacreous-white on the best preserved specimens, oval on its lower portion; periostracum?" Measurements of the type (in mm.): Length, 75; width, 40; height [lesser diameter], 35; height of aperture, 40; width of aperture, including outer lip, 30; major axis of aperture, 41.5; thickness of reflexed outer lip, 7; weight, 28.5 grs. The corresponding measurements of six paratypes are: 68, 75.5, 72, 77.5, 72, and 76; 37, 40, 41, 43, 41, and 40.5; 33, 35, 35, 37, 36, and 36; 35, 42, 40, 43, 40, and 40; 28, 31, 30, 33, 29.5, and 31; 37.5, 42.5, 41.5, 44, 41, and 41; 5, 5, 7, 7, 7, and 8; 18, 22.5, 22.5, 26.5, 17, and 22 grs.

STROPHOCHEILUS (MEGALOBULIMUS) GLOBOSUS (v. Martens)

Pl. 4, fig. 7; Pl. 15, fig. 2; Pl. 20, fig. 2

Bulimus globosus v. Martens, in Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 17 (no locality); 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., 2, p. 211.

Bulimus (*Borus*) *globosus* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 24; Pl. 140, figs. 2–3 (type; cites Pfeiffer, 1876, by page). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *globosus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 37; Pl. 2, figs. 2–3 (after v. Martens); 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 391 (Uruguay: subfossil at Montevideo); 1901, Man. of Conch., (2), **14**, p. 124; 1902, *Op. cit.*, (2), **14**, Classification, p. v. Marshall, 1928, The Nautilus, **42**, p. 21 (Uruguay: living in Dept. of Salto; subfossil at Punta Carretas, Montevideo; and at Vera, Dept. Soriano).

Strophocheilus globosus H. v. Ihering, 1907, An. Mus. Nac. Buenos Aires, (3), **7**, p. 427 (Uruguay: in Pleistocene deposits, Punta Carretas at Montevideo). Felippone and Barattini, 1938, Bol. Servicio Oceanográfico, Montevideo, **1**, pt. 1, p. 55 (misspelled "*blogosus*"); Pl. 5, figs. 1–2 (Uruguay: particularly in Depts. Maldonado and Paysandú).

Strophocheilus (*Microborus*) *globosus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6.

Bulimus lutescens Corsi, 1900, An. Mus. Nac. Montevideo, **2**, pt. 16, p. 406, fig. 26 (in part; specimens from Uruguay: Maldonado) Not of King and Broderip, 1832.

Strophocheilus felipponei H. v. Ihering, 1928, The Nautilus, **41**, p. 96 (Uruguay: Paysandú). Felippone and Barettini, 1938, Bol. Servicio Oceanográfico, Montevideo, **1**, pt. 1, p. 54.

In the discussion of the subgenus *Microborus* I give my reasons for transferring *S. globosus* from that group, where Pilsbry had placed it, to *Megalobulimus*.

v. Martens' type of *globosus* should be at the Berlin Museum. The type of *felipponei* is at the D.Z.S.P. and was kindly sent to me for study by Dr. Oliverio M. de Oliveira Pinto.

Specimens Examined. URUGUAY: Three bleached specimens without more definite locality (F. Felippone. — U.S.N.M.). Near Montevideo, 5 bleached specimens (S. Olea. — U.S.N.M.; M.U.Mich.; and Bicego. — M.C.Z.). Punta Carretas near Montevideo, 6 subfossil specimens (F. Felippone. — U.S.N.M.). Maldonado, 1 fresh and 1 bleached specimen (F. Felippone. — U.S.N.M.). Vera, Dept. Soriano, 1 bleached specimen (F. Felippone. — U.S.N.M.). Salto, 6 fresh specimens (A. Carceles. — M.C.Z.; and F. Felippone. — U.S.N.M.; M.N.H.Chic.). Paysandú, holotype of *felipponei* (F. Felippone. — D.Z.S.P. No. 7885) and 1 fresh specimen found alive (F. Felippone. — U.S.N.M.).

Summit very obtuse, broadly rounded; first nepionic whorl either flattened or somewhat sunken. No trace anywhere of microgranulation, even on well-preserved specimens, with fresh periostracum. Later nepionic whorls with regular, moderately spaced, low, vertical riblets. Suture minutely, irregularly crenulate. Fresh periostracum shiny, yellowish-brown to pale chestnut-brown, with a few darker, vertical streaks. Parietal callus very thin, whitish. Outer lip and columella white. Outer lip slightly or barely expanded, as a rule moderately thickened; slightly accrescent (3 mm. wide behind the rim) in one shell from Vera.

The type of *felipponei*, not figured thus far, is shown in Pl. 20, fig. 2. It was fairly clear from the more detailed description given in 1938 that *felipponei* was based on a nearly mature *globosus*. This conclusion is now borne out by a study of the type. It was said that *felipponei* differed from both *globosus* and *lutescens* in "the complete lack of an umbilical slit;" but in all *globosus* I have seen the umbilicus is completely closed.

According to v. Martens, the type of *globosus* measured (in mm.): length, 42; diameter, 31; length of aperture, 28.5; its width, 25 (including peristome) or 17 (inside outer lip). The measurements given in the original description (1928) of *felipponei* were clearly erroneous. The correct ones, given in 1938, were (in mm.): length, 38.5; length of aperture, 25; width of aperture, 17.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
41 mm.	29.5	26	27	17	4⅔	Punta Carretas
40	28	26.5	28	16.5	4⅔	" "
39.5	27	25	29	16	4⅔	Salto
39	28	26	25	14	4⅔	Montevideo
38.5	25	22.5	25	17	4⅔	Paysandú, holotype of *felipponei*
38.5	29	24.4	26.5	16	4⅔	Punta Carretas
36	26.5	24	26	15	4⅔	Paysandú
35	24	21.5	23.5	13	4⅓	Salto[1]

STROPHOCHEILUS (MEGALOBULIMUS) AURITUS (Sowerby)

Pl. 4, fig. 1; Pl. 26, fig. 3

Bulinus auritus Sowerby, 1838 (before October 31), Conchol. Illustr., *Bulinus*, fig. 76 of Pt. 140 (name in original letterpress list published with this part. Brazil: Bahia).

Bulimus auritus Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 151. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 25. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 190. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 304. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 25. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366; 1868, *Op. cit.*, **6**, p. 11; 1876, *Op. cit.*, **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 208.

Bulimus (*Borus*) *auritus* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 21. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *auritus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 26; Pl. 12, fig. 62 (after Sowerby); Pl. 16, fig. 26 (specimen); 1901, *Op. cit.*,

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[1] Probably immature.

(2), **14**, p. 121; Pl. 23, fig. 97 (specimen); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus ovatus var. Reeve, 1850, Conch. Icon., **5**, *Bulimus*, Pl. 89, fig. 212*b* (Bahia).

Strophocheilus (*Borus*) *versatilis* Fulton, 1905, Jl. of Malacology, **12**, p. 24; Pl. 6, fig. 1 (? Brazil).

Sowerby's type of *B. auritus* and that of Fulton's *S. versatilis* are at the British Museum (M. Connolly, *in litt.*, 1946).

Specimens Examined. BRAZIL: Several without more definite locality (A.M.N.H.; M.U.Mich.; U.S.N.M.; M.C.Z.). Victoria, Est. Espírito Santo (Thayer Exp. — M.C.Z.). "Rio de Janeiro" (this specimen came more probably from some locality in the interior of the State of Rio) (Thayer Exp. — M.C.Z.). Cachoeira de Santa Leopoldina, Est. Espírito Santo (M.U.Mich.). S. Antonio de Vargem, Alegre, Est. Minas Geraes (H. v. Ihering. — U.S.N.M.). São Paulo (N.H.M.Chic.). Est. Espírito Santo (E. Garbe. — M.C.Z.).

S. auritus is medium-sized (76 to 102 mm. long), light, moderately thick, ventricose-elliptical. Spire only slightly more tapering than base (except for protruding lower portion of aperture), very short, with obtusely rounded summit; earliest nepionic whorls depressed. Body-whorl scarcely more convex than penultimate whorl, not saccate at base on left side, with shallow suture, which is very oblique from the back, more so than the suture above it. First and part of second whorl smooth; remainder of nepionic shell with broad, low riblets, a little narrower than their intervals, gradually more spaced while tending to spread apart or fade toward the lower suture, disappearing almost entirely beyond third whorl. Vertical sculpture of post-nepionic whorls very weak, except below the suture. Ribbed portion of nepionic and most of post-nepionic whorls of fresh specimens with very dense, minute granulation, rather irregularly arranged in spiral lines, usually very weak on last portion of body-whorl, the surface of which is more or less malleated, sometimes scarcely so. Aperture of fully adult shells ear-shaped in outline; basal part of outer lip nearly straight, thickened and flattened into a blunt edge which joins the columella at a rounded right angle. Right margin of outer lip nearly straight; rim much thickened about mid-length, producing on the inner edge an elongate swelling, very variable in size. Upper part of parietal wall of older shells as a rule with a hump or flattened tubercle, also variable in size and sometimes absent. Umbilical slit usually narrowly rimate, sometimes completely closed. Periostracum often well preserved, pale brown-olivaceous; upper whorls with a reddish tinge due to the color of the shell itself; this reddish color shows also in denuded specimens, which in addition often have an ill-defined pale band below the suture. Outer lip, columella and parietal wall white in all specimens seen.

The only tangible difference between Fulton's description and figure of *S. versatilis* and most specimens of *S. auritus* is in the malleation of the body-whorl, said to be conspicuous in *versatilis*. This is, however, extremely variable in the series I have seen, the variation not being correlated with any other distinctive character, particularly not with the absence of a tubercle on the upper part of the parietal wall.

The measurements of Sowerby's figure of the type are: length, 76 mm.; width in front view, 42.5 mm.; aperture, 40 by 17 mm. Pilsbry's specimens measured: length, 84, 87, and 89 mm.; diameter, 50, 49, and 47 mm.; length of aperture, 40, 46, and 49 mm. Fulton's type of *versatilis* measured 98 mm. in length and 49 mm. in diameter, and is one of the largest specimens on record for the species. Pfeiffer (1853), however, saw one 100 mm. long, 48 mm. wide, with the aperture inside 40 mm. long and 20 mm. wide.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
102 mm.	61	56	63	26	5½	Brazil
97	53	47	52	21	5½	Sa. Leopoldina
95.5	53	47	52	21	5½	Rio de Janeiro
90.5	51	44.5	49.5	20	5½	Brazil
89.5	51	43	49	20	5½	"
89.5	52	44	49	19.5	5½	"
89	51	45	49.5	21	5½	Victoria
84	47.5	41.5	45	18.5	5½	"

STROPHOCHEILUS (MEGALOBULIMUS) OVATUS (O. F. Müller)

The specific characters of *S. ovatus* are described below for the typical race. In addition to this, I recognize provisionally two other subspecies; but the distribution of all three races is imperfectly known. Typical *ovatus* is definitely known only from the states of Rio de Janeiro and São Paulo. Subsp. *chionostoma,* recorded from the states of Rio de Janeiro, Maranhão and Paraná, is perhaps based on individual variants only. Subsp. *grandis,* which occurs in Matto Grosso and São Paulo, appears to be a true subspecies.

a. Typical OVATUS

Pl. 7, fig. 4; Pl. 16, fig. 5

[Lister, 1692, Synopsis Meth. Conchyl. Liber IV, Appendix, Pl. 1055, fig. 1 (no locality)].

[Davila, 1767, Cat. Syst. Raisonné Curios., **1**, p. 134 ("fausse oreille de Midas . . . de Rio-Janeiro, à orbes plus renflés que tous les précédents, revêtu de son épiderme, fascié de bandes longitudinales de fauve clair et de fauve roux")].

[J. S. Schröter, 1784, Einleitung Conchylienkennt., **2**, p. 203 (No. 91, with reference to Lister's Pl. 1055, fig. 1)].

[Chemnitz, 1786, Syst. Conch. Cab., **9**, pt. 2, p. 28; Pl. 119, figs. 1020–1021 (with reference to *Helix ovata* Müller; but the figured specimen, from Chemnitz' Collection, apparently was not Müller's type[1])].

Helix ovata O. F. Müller, 1774, Verm. Terr. Fluv. Hist., **2**, p. 85 (description of a shell in Spengler's Collection; "in India orientali"). Dillwyn, 1817, Descr. Cat. Rec. Shells, p. 931. J. Mawe, 1823, Linn. Syst. Conch., p. 167.

Bulimus ovatus Bruguière, 1789, Encyclop. Méthod., Vers, **1**, pt. 1, p. 318. Bosc, 1802 (An. X), Hist. Nat. Coq., **4**, p. 100. de Roissy, 1805 (An XIII), Hist. Nat. Moll., **5**, p. 336. Lamarck, 1822, Hist. Nat. Anim. Sans Vert., **6**, pt. 2, p. 116. Wagner, 1827, in Spix, Test. Fluv. Brasiliam, p. 12; Pl. 11, fig. 1 (Brazil: Sebastianópolis [=São Sebastião], Est. Rio de Janeiro). Menke, 1828, Synops. Meth. Moll., p. 14. Jay, 1835, Cat. Shells Coll., p. 10; 1836, *Op. cit.*, 2d Ed., p. 41; 1839, *Op. cit.*, 3d Ed., p. 56; 1850, *Op. cit.*, 4th Ed., p. 204. d'Orbigny, 1837, Voy. Amér. Mérid., **5**, Pt. 3, Moll., p. 299 (Brazil: Rio de Janeiro). Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 211; 1844, *Op. cit.*, 3d Ed., **3**, p. 348. Pfeiffer, 1840, Krit. Register Konch.-Kab., p. 84. A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 20. Küster, 1841, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 4; Pl. 1, figs. 1–2. Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 119. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 158. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 36, fig. 212. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 19; 1849, Zeitschr. f. Malakoz., **6**, p. 15. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 35 (in part); Atlas, Pl. 147 (Expl. of Plates, p. 20. Plate published with name *Helix ovata* in 1832). Pfeiffer, 1852, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. iii; 1853, Monogr. Helic. Viv., **3**, p. 303. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 25. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 365. v. Martens, 1865, Preussische Exped. Ost-Asien, Zool., **1**, p. 38; 1867, *Op. cit.*, **2**, p. 7 (Brazil: Rio de Janeiro). A. D. Brown, 1861, Cat. Shells Coll., p. 47; 1866, *Op. cit.*, 2d Ed., p. 59. Haines, 1868, Cat. Terr. Shells Coll., p. 53. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 10. v. Martens, 1868, Malak.

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[1] Chemnitz saw, in addition to the shell he figured, several specimens in the Spengler Collection, so that no doubt he was acquainted with Müller's type.

Blätt., **15**, p. 176. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 12; 1877, *Op. cit.*, **8**, p. 604. P. Fischer, 1880, Manuel Conchyliologie, p. 90, fig. 82 (egg). Leunis, 1883, Synopsis d. Thierkunde, 3d Ed. (by H. Ludwig), **1**, p. 887. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215. Plate, 1896, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 149 (anatomy). Julia E. Rogers, 1908, The Shell Book, p. 271; Plate opposite p. 278, figs. 3–4. de Souza Lopes, 1940, Revista de Entomologia, **11**, p. 927 (Brazil: Tijuca, Rio de Janeiro; associated with borborid flies).

Helix (*Cochlogena*) *ovata* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 54 (Brazil). Rang, 1831, Ann. Sci. Nat., **24**, p. 48 (in part: animal. Brazil). Férussac, 1832, Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 147 (animal; plate published with name). d'Orbigny, 1835, Mag. Zool., **5**, Class V, No. 61, p. 15.

Cochlogena ovata Sowerby, 1825, Cat. Coll. Earl Tankerville, p. 39.

Helix (*Bulimus*) *ovatus* Voigt, 1834, in Cuvier, Das Thierreich, **3**, p. 78.

Bulimus (*Bulimus*) *ovatus* Beck, 1837, Index Moll., pt. 1, p. 53. Anton, 1839, Verzeichniss Conchyl. Samml., p. 40. Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27; 1857, Cat. Conchyl. Suenson, p. 8.

Bulimus (*Borus*) *ovatus* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2** (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191; 1876, Novit Conchol., Abt. I, **5**, pts. 50–51, p. 14 (Brazil: Nova Friburgo, Est. Rio de Janeiro). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878) p. 121. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119.

Borus ovatus Mörch, 1865, Jl. de Conchyl., **13**, p. 385 (jaw). Standen 1917, Jl. of Conchol., **15**, p. 159 (egg). Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (egg).

Strophocheilus (*Borus*) *ovatus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 24 (Brazil: Bahia; near Petrópolis); Pl. 12, figs. 60 (specimen) and 61 (after Reeve); 1896, *Op. cit.*, (2), **10**, p. 195; 1902, *Op. cit.*, (2), **14**, Classification, p. v. Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 45. Martins, 1945, Rev. Mus. Nac., Rio de Janeiro, **2**, p. 19, fig. (living animal. Brazil: Sumaré, Sa. Teresa, D.F.).

Strophocheilus (*Megalobulimus*) *ovatus* Haas, 1939, Senckenbergiana, **21**, p. 269 (Brazil: between Areias and Arará; Cariry; both Est. Parahyba).

Helix ovipara Solander, 1786, Catalogue Portland Museum, p. 155 (Surinam, with reference to Lister, Pl. 1055, fig. 1). See W. H. Dall, 1921, The Nautilus, 34, p. 99.

Helix ovalis Gmelin, 1790, in Linné, Syst. Nat., 13th Ed., **1**, pt. 6, p. 3637 (with references to Müller, Hist. 2, p. 85, No. 283; and to Chemnitz, Pl. 119, figs. 1020–1021). J. Mawe, 1812, Travels in the Interior of Brazil, Plate of Mollusks, lower left hand fig. (with name).

Bulinus ovalis Sowerby, 1835, Zool. Journ., **5**, No. 20, p. 495 (Brazil: Rio de Janeiro. Egg).

? *Helix* (*Cochlogena*) *ovum* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 54 (*nomen nudum*; no locality).

? *Bulimus* (*Bulimus*) *ovum* Beck, 1837, Index Moll., pt. 1, p. 52 (no description; with reference to *H. ovum* Férussac).

Bulimus ovum "Bruguière" H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146 (error for *ovatus*).

Strophocheilus haemastomus Spix, 1827, in Wagner, Test. Fluv. Brasiliam, Pl. 11, fig. 1 (with name); p. 12 (as a synonym of *Bulimus ovatus* Müller). Not of Scopoli, 1786.

Bulinus haemastomus Booth, 1830, Zool. Journ., **5**, No. 17, p. 101 (Brazil: Rio de Janeiro. Egg.) Sowerby, 1835, *Op. cit.*, **5**, No. 20, p. 495.

Bulimus haemastomus Wood, 1828, Supplement Index Testaceologicus, p. 31. Hanley, 1840, Young Conchologist's Book Species, p. 32. Swainson, 1840, Treatise on Malacology, pp. 178 and 179, fig. 26.

Helix oblonga Wood, 1818 (and 1825), Index Testaceologicus, Pl. 34, fig. 102 (not the reference on p. 162); 1856, *Op. cit.*, Hanley Ed., p. 170; Pl. 34, fig. 102. Not of Müller, 1774.

Limnaea imperialis I. Lea, 1834, Trans. Amer. Phil. Soc., **5**, p. 81; Pl. 19, fig. 73 ("South America"; a young *S. ovatus*, as recognized by Pilsbry, 1896).

Müller's type may yet be at the Copenhagen Museum. Gmelin's *ovalis* was not based on an actual specimen, but merely an error or an emendation for *ovatus*. Lea's type of *L. imperialis* is at U.S.N.M.

A correct habitat of this striking shell was first given by Davila (1767), who stated that he received it from Rio de Janeiro. Müller thought that it was East Indian and Chemnitz gave Tranquebar, Coromandel, Ceylon, and Nicobar as possible habitats. v. Martens (1867) bought live specimens in the market at Rio de Janeiro. There are thus far six other published reliable localities, two in Parahyba and four in Rio de Janeiro. I have seen it also from São Paulo. In view of the occurrence in Parahyba, Pilsbry's Bahia record may be correct, although it needs to be confirmed.[1]

Specimens Examined. BRAZIL: Several without more definite locality (A.M.N.H.; U.S.N.M.; M.C.Z.; M.U.Mich.; M.N.H.Chic.). Near Rio de Janeiro (M.C.Z.). Recreio de Bandeirantes, Est. Rio de Janeiro (D. M. Cochran. — U.S.N.M.). Therezópolis, Est. Rio de Janeiro (K. P. Schmidt. — M.N.H.Chic.). Avenida Niemeyer, D. F., Est. Rio de Janeiro (D. M. Cochran. — U.S.N.M.). Nova Almeida on Rio Itabapoana, Est. Rio de Janeiro (M.C.Z.). Mt. Mantiqueira, Est. Rio de Janeiro (Ralph Humes Coll.). Serra do

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[1] Pilsbry gives Spix and Anthony as authorities for his Bahia record. The first apparently refers to Spix' *Bulimus terrestris*, at one time thought to be a young *S. ovatus*, whereas I regard it as the young of Rang's *H. cantagallana*. Anthony's shell probably came from the Thayer Expedition, the material of which was often mislabeled as to localities.

Rio Preto near Campos, Est. Rio de Janeiro (M.C.Z.). Near São Fidelis on Rio Paraiba do Sul, Est. Rio de Janeiro (M.C.Z.). Ilha Victoria, Est. São Paulo (F. Gunther. — M.C.Z.). Ubatuba, Est. São Paulo (E. Garbe. — M.C.Z.). Itanhaém, Est. São Paulo (M.C.Z.).

S. ovatus is very large (108 to 150 mm. long in typical race), moderately thick, light for its size, broadly elliptical, but with flattened sides, widest about mid-length. Spire only slightly more tapering than base, very short, with bluntly pointed summit; earliest nepionic whorls well raised. Body-whorl strongly but evenly convex, not saccate at base to left of columella; suture shallow, very oblique from the back. First nepionic whorl smooth; second and third with low, fairly broad riblets, much closer together and narrower than in *S. bronni*, about as wide as their intervals below the suture, but spreading apart considerably farther down the whorl; beyond the third whorl the riblets fade gradually, at first in the lower portion, later over most of the surface; only weak traces of them on penultimate and body-whorl, below the suture. Granulose microsculpture very fine, somewhat in spiral rows on second to fourth whorls, extremely minute and irregular on fifth, almost lacking on sixth. Growth striae very weak, the body-whorl particularly being glossy, though uneven through a more or less pronounced malleation and short, irregular, transverse, impressed lines. Aperture very long, slightly over half the total length of shell, comparatively narrow, semi-elliptical. Columella rather thin, straight, curving evenly into base of outer lip. Parietal wall usually only moderately calloused, without distinct hump in upper portion. Outer lip strongly expanded, with a moderately thick, reflexed rim, which in older shells is much narrower in upper third than elsewhere; in addition, rim sometimes very slightly swollen, about mid-length, but never as much as in *S. auritus*. Umbilical slit either completely closed or very narrowly rimate. Periostracum often well-preserved and then very glossy, with a varnished appearance, chestnut-brown with many darker and lighter vertical streaks; upper whorls more or less denuded, reddish-brown, usually with an ill-defined subsutural pale band, which rarely extends to the body-whorl. Aperture inside and parietal wall bluish-white; columella white over inner upper half, roseate over outer half and base; outer lip more or less pink or roseate in the typical subspecies, but extent of this color very variable, often restricted to the outer edge or basal portion, sometimes present only as faint traces.

Müller gave the original (Danish) measurements of his *H. ovata* as: length, 4 inches 3 lines [=111 mm.]; width, 2 inches 3 lines [=60 mm.].

The specimen figured by Chemnitz (not the type) was 117 mm. long, 72 mm. wide, the aperture 75 by 32 mm.; it shows the median swelling of the outer lip more pronounced than in any *ovatus* I have seen, yet is undoubtedly what is now called *ovatus* and could not possibly represent *S. auritus* (Sowerby). The largest specimen recorded by Pilsbry was 128 mm. long, 80 mm. wide, the aperture 69 by 54 mm. v. Martens (1876), however, saw one 135 mm. long, 80 mm. wide, the aperture 84 by 32 mm. Dr. E. A. Martins kindly informs me (*in litt.*, 1946) that his figure of a living *ovatus* was slightly enlarged, the shell being actually 135 mm. long and 70 mm. wide in front view, the aperture 76 by 40 mm. (width including the rim). He also states that the largest *ovatus* at the Rio de Janeiro Museum is 139 mm. long, 77 mm. in greatest width, with the aperture 75 by 40 mm.

Measurements of Adult Shells

	Width in front view	Width in profile	Aperture			
Length			Length	Width	Whorls	
146 mm.	79	68	88	33	6	Brazil
138	71.5	65	79	30	5⅜	“
128	64	57	73.5	28.5	5½	Serra Mantiqueira
121.5	71	64	78.5	32.5	5½	Rio de Janeiro
120	67	62	75	30	5½	“ “ “
117	66.5	60	70.5	28.5	5½	“ “ “
116	64	61	71	30	5½	“ “ “
115.5	71.5	63	74	31	5½	“ “ “
113	62	55.5	65	27	5½	Brazil
108.5	68	57	67	28	5½	Rio de Janeiro

Original description of *H. ovata:* "*Helix* testa perforata, ovato-ventricosa, strigata, apice costato, labroque roseis, columella candida. *H. oblongae* accedit, at species diversissima. Testa crassa, lumini obversa subpellucida, ventricosa, lutea, clavicula rosea. Anfractus sex, majores duo strigis longitudinalibus fuscis fasciarum instar, reliqui costis seu lineis elevatis insigniuntur. Epidermis in majori anfractu rugulosus. Apertura ovalis. Faux et paries oppositus cum labio adnato lacteus est. Labrum crassum, reflexum, roseum, in medio (ab angulo metiendo) splendide incrassatum, nota huic speciei propria. Pone labrum foramen. Axis uti in *H. oblonga.*"

b. S. OVATUS CHIONOSTOMA (Mörch)

Pl. 8, fig. 6

Helix (*Cochlogena*) *ovata* "Var. apertura candida" Férussac, 1827, Bull. Sci. Nat. Géol., **10**, p. 305 (animal. Brazil: near Rio de Janeiro).

Bulimus chionostoma Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27 (Brazil: no description; defined only by the references "*B. ovatus* var. Pfr.; *B. ovatus* Sw. Treat. p. 178, fig. 26").

Bulimus (*Borus*) *ovatus* var. *chionostomus* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 15 (Brazil: Bahia. Bolivia).

Bulimus ovatus var. *chionostomus* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215.

Strophocheilus (*Borus*) *ovatus* var. *chionostomus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 25; Pl. 21, fig. 49 (specimen); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Helix (*Cochlogena*) *ovata* Rang, 1831, Ann. Sci. Nat., **24**, p. 49 (in part: the variety with white peristome).

Bulimus ovatus "var. peristomate albo" Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 20. Hidalgo, 1870, Jl. de Conchyl., **18**, p. **41** (Brazil: Macahé, Est. Rio de Janeiro); 1872, Moluscos del Viaje al Pacífico, **1**, p. 47; 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 68, 88, and 194.

Bulimus ovatus var. β Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 303.

Bulimus cantagallanus Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 30; Atlas, Pl. 160, figs. 11–12 (Expl. of Plates, p. 21); 1866, Actes Soc. Linn. Bordeaux, **25**, p. 483; Pl. (animal). Crosse and Fischer, 1875, Mission Scientif. Mexique, Moll. Terr. Fluv., **1**, p. 469; Pl. 22, figs. 12–17 (anatomy of the specimen figured by Deshayes in 1866). P. Fischer, 1883, Manuel Conchyliologie, p. 467, fig. 243 (radula), and p. 472, fig. 245 (jaw). Not of Rang, 1831.

The type of *chionostoma* is presumably the specimen seen by Mörch in Yoldi's Collection, but its present location is unknown (perhaps in Copenhagen?) It should be noted that Mörch's references scarcely define the name. He cites Swainson's figure by error.[1] As for "*B. ovatus* var. Pfr.", it is only by inference or tradition that this can be correlated with Pfeiffer's note of 1848: "Obs. Variat rarior peristomate albo." v. Martens (1876) seems to have been the first to use the name *chionostoma* unambiguously for the white-mouthed variety of *S. ovatus*, as distinct from *S. terrestris* (=*cantagallanus*), which he redescribed as *intercedens*.

Hidalgo (1870) first referred Férussac's Pl. 160, figs. 11–12, to the white-mouthed form of *S. ovatus* and v. Martens (1876) followed him.

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[1] Swainson called his shell *Bulimus haemastomus* and he stated (p. 179) that it had a rosy peristome.

Pilsbry (1895) casts some doubt upon this identification, but I believe without reason. It is true that Férussac's figures are more slender and with a narrower mouth than usual; but I have seen specimens of *S. ovatus* which agree in every respect with them. On the other hand, these figures do not represent either *S. terrestris* (=*cantagallanus*) or *S. terrestris gummatus*.

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; M.U.Mich.; U.S.N.M.; Ac.N.S.Phila.; A.M.N.H.). São Luiz, Est. Maranhão (R. Humes Collection). Paranaguá, Est. Paraná, on the coast (M.U.Mich.). Cantagallo, Est. Rio de Janeiro (M.N.H.Chic.). Tijuca, D. F., Est. Rio de Janeiro (D. M. Cochran. — U.S.N.M.). Paineras near Corcovado, D. F., Est. Rio de Janeiro (D. M. Cochran. — U.S.N.M.).

The only other reliable definite locality known thus far is Macahé, on the coast near Cabo Frio, northeast of Rio de Janeiro. The supposed occurrence at Bahia is most doubtful and "Bolivia" has certainly been given by error.

The pure white peristome alone separates *chionostoma* from typical *S. ovatus;* but this character is of dubious subspecific value, particularly as in some typical and apparently fresh *S. ovatus* the outer lip shows only traces of pink and in some specimens it may be difficult to decide about this. In addition in most, though not in all white-lipped specimens the early whorls also are nearly white underneath the periostracum, which is as a rule lighter and more yellowish than in typical *ovatus*. Probably *chionostoma* is really an albino form of *ovatus*, analogous to *S. oblongus albus* Bland and Binney.

The measurements of Mörch's original specimen are not known.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
143 mm.	78	65.5	88	34.5	5½	Brazil
135	74.5	63	81	32	5½	Tijuca
132	80	66	82	32	5⅓	São Luiz
125	66	56	73	28	5⅓	Brazil
120	67.5	65	74	30.5	5⅓	"
116	66.5	58.5	70.5	30	5⅓	"
114	65	57.5	74	26.5	5½	"

c. S. OVATUS GRANDIS (v. Martens)

Pl. 6, fig. 5; Pl. 9, fig. 8; Pl. 14, fig. 6; Pl. 25, fig. 5; Pl. 30, fig. 1

Bulimus grandis v. Martens, 1885, Sitzungsber. Ges. Naturf. Fr. Berlin, p. 148 (Brazil: Descalvados, Est. Matto Grosso).

Bulimus (*Borus*) *grandis* v. Martens, 1889, Conchol. Mith., **3**, pts. 1–2, p. 9; Pl. 39 (type).

Strophocheilus (*Borus*) *grandis* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 26; Pl. 13, fig. 68 (after v. Martens); 1901, *Op. cit.*, (2), **14**, p. 122 (Brazil: Ilha São Sebastião, Est. São Paulo); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus martensianus Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. lxxi (new name for *B. grandis* v. Martens).

v. Martens' type should be at the Berlin Museum. Pilsbry's change of name seems unnecessary. *Bulimus grandis* Deshayes (1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., 2, pt. 2, p. 101) was merely a new combination for *Pupa grandis* Pfeiffer, 1846, a species now placed in *Edentulina.*

Specimens Examined. BRAZIL: Ilha São Sebastião, Est. São Paulo (M.U.Mich.; U.S.N.M.; Ac.N.S.Phila.). Below Descalvados on the Paraguay River, Matto Grosso, an immature, poorly preserved shell, unquestionably of this form (K. P. Schmidt. — M.N.H.Chic.).

S. ovatus grandis is one of the largest members of the genus, although more slender and hence less capacious than *S. popelairianus.* Shell elongate-ovate, widest slightly below mid-length, more tapering at spire than at base; all whorls about equally and moderately convex, with shallow sutures; summit bluntly pointed; nepionic whorls distinctly raised above one another. Riblets of nepionic whorls low, broad, widely spaced and spreading apart downward, the intervals nearly twice as wide as a riblet below the suture on the third whorl. Granulose microsculpture weak, about as in *S. oblongus.* Body-whorl in front view relatively much longer and spire shorter than in *oblongus,* about as in typical *S. ovatus;* suture of terminal portion of body-whorl, seen from the back, much more oblique than the one above it. Aperture very long and narrow, slightly over half the total length of shell, semi-elliptical. Columella rather thin, straight, curving evenly at base into outer lip. Parietal wall only moderately calloused, without hump. Outer lip strongly reflexed, with a moderately thick rim, which is much narrowed in upper third near parietal wall. Umbilical slit almost completely closed. Periostracum tawny-chestnut, with a paler subsutural band on upper whorls. Parietal wall and inside of mouth whitish; columella and outer lip bright rose colored, inner upper edge of columella whitish.

Although *grandis* is much more slender than typical *ovatus*, a study of the more reliable characters of sculpture and aperture has led me to subordinate it to *S. ovatus*. When he described *grandis*, v. Martens recognized the close relationship to *ovatus*, even suggesting that it possibly was based on an individual variant only. However, as all seven adult specimens seen are consistently separable from typical *ovatus* and as no intermediate specimens are known, it would seem that *grandis* is a valid subspecies.

v. Martens' type was 153 mm. long, 83 mm. in greatest diameter, 62 mm. in least diameter, with the aperture 92 by 45 mm. (the width measured to the outer margin of the lip.)

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
154 mm.	78	64	94	37	5½	São Sebastião
138	73	61	86	33	5½	" "
134	72	57	75	33	5½	" "
128	67.5	56.5	71	29	5½	" "

STROPHOCHEILUS (MEGALOBULIMUS) BRONNI (Pfeiffer)

a. Typical BRONNI

Pl. 5, fig. 3; Pl. 22, fig. 1; Pl. 32, fig. 2

Bulimus bronni Pfeiffer, 1847, Zeitschr. f. Malak., **4**, p. 31 (Brazil); 1848. Monogr. Helic. Viv., **2**, p. 22. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 191, Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 304; 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 254; Pl. 69, fig. 1 (type). Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 25. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366; 1868, *Op. cit.*, **6**, pp. 11 and 524. Haines, 1868, Cat. Terr. Shells Coll., p. 44. Paetel, 1869, Moll. Syst. Cat., p. 79; 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 209.

Bulimus (*Borus*) *bronni* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 16. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Strophocheilus (*Borus*) *bronni* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 28;

Pl. 15, figs. 18–19 (specimen); Pl. 16, fig. 27 (specimen); 1902, *Op. cit.*, (2) **14**, Classification, p. v.

Strophocheilus (*Megalobulimus*) *bronni* Haas, 1937, Arch. f. Molluskenk., **69**, p. 244 (Brazil: São Francisco dos Campos, 1,500 m.; Itajubá; both Est. Minas Geraes).

Borus bronni Standen, 1917, Jl. of Conchol., **15**, p. 159 (egg). Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (egg).

Bulimus browni "Pfeiffer" H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146 (error for *bronni*).

Helix ovata Férussac, 1823, Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 145B, figs. 2–2*a* (shell and egg; no name on plate, but name on cover of Livr. 21, according to Kennard, 1942, Proc. Mal. Soc. London, **25**, pt. 1, p. 16). Not of O. F. Müller, 1774.

Bulimus ovatus Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 35 (in part) (Expl. of Plates of Atlas, p. 20).

Helix ovalis, variety, J. Mawe, 1812, Travels in the Interior of Brazil, Plate of Shells, 3 upper left hand figs. (animal with shell, egg and shell; without description; referred to, without specific name, on p. 199 of the text, as found at Villa Rica [now Ouro Preto], Est. Minas Geraes). Not of Gmelin, 1790.

Strophocheilus (*Borus*) *granulosus* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 195 (reference to Mawe's var. of *H. ovalis*). Not of Rang, 1831.

Borus cantagallanus Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (cites Mawe's fig. of egg). Not of Rang, 1831.

The type of *bronni*, originally in Pfeiffer's own collection, may be at the Stettin Museum. Mawe's type of the variety of *ovalis* is probably lost.

Specimens Examined. BRAZIL: several without more definite locality (A.M.N.H.; M.C.Z.; M.U.Mich.). State of São Paulo (H. v. Ihering. — U.S.N.M.). Itatiaya, Est. Rio de Janeiro (Rose and Russell. — U.S.N.M.).

Shell medium-sized (70 to 93 mm. long), solid, rather thin, nearly elliptical in outline, with the greatest width about mid-length, scarcely more tapering at spire than at base, distinctly flattened dorso-ventrally. Body-whorl very long, about five-sixths of the total length in front view, only slightly more ventricose than penultimate whorl, not saccate to the left of columella. Summit obtuse; earliest whorls somewhat depressed. First one and a half nepionic whorls smooth; next with a few strong, broad riblets, placed gradually farther apart, broader, more spaced and stronger than in *S. ovatus* and *S. auritus*; over about one whorl they are continuous from suture to suture, with intervals about one and a half to three times as wide as a riblet; the intervals then become wider (2 to 3 times the width of a riblet), while the riblets gradually disappear from the lower part of the whorl. Last half of penultimate and entire body-whorl with only weak, irregular folds, slightly crenulating the suture. Surface of body-whorl more or less malleated, often only very weakly. Microsculpture of distinct fine granules in spiral rows on the early whorls, extending in the typical form over the first third only of body-whorl, replaced farther on by exceedingly minute, wavy, coalescent vertical wrinkles. Aperture narrow, semi-elliptical, very oblique, its lower left angle much to the left of vertical axis of shell. Columella rather narrow and thin, straight but oblique, closing the umbilical slit nearly completely, forming a rounded angle with the base of outer lip. Parietal wall weakly calloused, without hump. Outer lip, when fully formed, slightly expanded; rim moderately and uniformly thickened. Periostracum very dark brown, with lighter streaks on body-whorl. Parietal wall and inside of aperture bluish-white; columella and outer lip pale pink, often much faded or even whitish.

Mawe's figures of the snail he obtained at Villa Rica fit specimens of *S. bronni* in every way. He gave of this snail the following account: "I had commissioned some persons to collect land snails for me during my absence, and was now to my great satisfaction presented with six, of a fine chestnut brown colour, with beautiful pink mouths, belonging to a new variety of the helix. Having kept them a few days, without taking out the animals, I was surprised to find that one of the latter had laid two eggs. I had not before imagined that they were oviparous. I took one of the shells in my hands, while the animal was crawling, when it immediately folded itself, and entered very quickly, in which exertion another egg was deposited in the mouth of the shell. All the eggs were about the size of a sparrow's. These were the only land shells I had seen on this journey." Pilsbry (1896) refers Mawe's figures to *S. granulosus* (Rang), but in that species the base is saccate to the left of the columella, the spire is relatively higher and more tapering, and the suture of the last turn of the body-whorl (seen from the back) descends much more obliquely than shown in Mawe's figures, which in these respects agree well with specimens of *bronni.* I have reproduced one of Mawe's figures (Pl. 5, fig. 3), as his book is difficult to consult. The size of his shell also agrees better with *bronni* than with *granulosus.*

Mawe's figure of *ovalis* is 72 mm. long, 44 mm. wide, the aperture 48 by 21 mm.; the egg he figured is 14.5 mm. long and 9 mm. wide. Pfeiffer's measurements of *bronni* were (in mm.): "Long. 90, diam. 43. Apert. 55 longa, intus medio 26 lata." Pilsbry gave for one of his specimens: "Alt. 79, diam. 46 mm.; apert. alt. 48, width 31 mm.; width, inside peristome and columella, 21 mm."

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
92.5 mm.	53	46	55	22	5	Brazil
85.5	52	45.5	53	24	5	"
84	48	40.5	53.5	22.5	5	"
80	45.5	36.5	49	20.5	5	"
76.5	44	38	48	23	5	"

b. S. BRONNI PERGRANULATUS Pilsbry

Pl. 13, fig. 8; Pl. 24, fig. 4

Strophocheilus (*Borus*) *bronni* var. *pergranulatus* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 120 (Brazil: Piquete, Est. São Paulo); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

The type of *pergranulatus* is at the Ac.N.S.Phila. (No. 71231), where I have seen it. It is here figured for the first time.

Specimens Examined. BRAZIL: Piquete, Est. São Paulo, holotype (H. v. Ihering. — Ac.N.S.Phila.) and two topotypes from the same collector, but not seen by Pilsbry (U.S.N.M.; M.C.Z.). Est. Rio de Janeiro (F. Schade. — M.C.Z.). Independencia near Petrópolis, Est. Rio de Janeiro (D. N. Cochran. — M.C.Z.). Campos de Jordão, Est. São Paulo (H. Luederwaldt. — M.C.Z.).

The subsp. *pergranulatus* differs from typical *bronni* only in the coarser and more extensive sculpture of granules and fine wavy, vertical lines of the body-whorl, often extending to close to the outer lip, though gradually weaker. The shell is consequently much duller in appearance than typical *bronni*. The other differences given in the original account do not seem to be reliable, being too variable in the typical, smoother *bronni* I have studied. The peristome varies from roseate to nearly white. I was at first inclined to sink *pergranulatus* as a synonym, but the specimens before me are readily separated from the other *bronni* and I have seen no transitional shells.

It should be pointed out that Pfeiffer was acquainted with both forms of *S. bronni* when he described the species. In fact his main description, in 1847, was based on the completely granulose form (*pergranulatus*), since he described his var. β : "paulo minor, anfractu ultimo vix granulato, potius malleato-impresso." It is not possible to decide which of the two forms he figured in 1855. Under the circumstances, Pilsbry may be regarded as the first reviser, defining typical *bronni* as the form almost without granulation on the body-whorl.

Pilsbry published no measurements of the holotype, but these are given below.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
90 mm.	53	44	56	25	5	Est. Rio de Janeiro
86.5	51	41	55	26	5	Independencia
86	46.5	42.5	50.5	21	5	Rio de Janeiro
80	45.5	39	46	21	5	Piquete, holotype
75	42	37	44	20	5	" "

A young shell of *S. bronni* (Plate 22, Fig. 1), 44 mm. long, of 3¾ whorls, from Serra de Macahé, Est. Rio de Janeiro, was received from the Departamento de Zoologia of São Paulo, as a new species with a manuscript name based on that of the collector, E. Garbe. Due to its dull and coarse surface it most likely belongs to the subsp. *pergranulatus*.

c. S. BRONNI FRAGILIOR H. v. Ihering

Pl. 21, fig. 1

Strophocheilus (*Borus*) *fragilior* H. von Ihering, 1901, in Pilsbry, Man. of Conch., (2), **14**, p. 121; Pl. 20, figs. 60–61 (Brazil: Rio Grande, Est. São Paulo); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

The type is at the Departamento de Zoologia, Secretaria da Agricultura, São Paulo (formerly Museu Paulista). The original figure was drawn from the type, which was evidently examined by Pilsbry. It is not certain whether the description was written by him or by von Ihering. In any case, Pilsbry credits the name to von Ihering only.

Specimens Examined. BRAZIL: Rio Grande, Est. São Paulo, two topotypes, received from the Departamento de Zoologia (M.C.Z. No. 179224).

A study of the two topotypes and of the original description and figures leads me to regard *fragilior* as at most a race of *bronni*, with which it agrees in the sculpture of the nepionic whorls. It differs consistently from typical *bronni* and the subsp. *pergranulatus* in being relatively shorter and broader, with a much shorter spire, the penultimate whorl particularly being wider in proportion to the length and the body-whorl being more ventricose. Pilsbry states that the last 1½ whorls are "minutely wrinkled and granulose, the granulation like that of *S. bronni*, becoming much sparser on the last half whorl, and less regularly arranged in spiral lines." This applies well to one of the topotypes; but in the other the granulation is as in *pergranulatus*, extending strong and regular to the outer lip. The shell, moreover, is dull. The aperture is as in *bronni*, in one topotype with the outer lip slightly accrescent (rim 3 mm. wide in profile). In the type the peristome was bright rose; in the two topotypes it is very faded, faintly pinkish, as in most typical *bronni* seen.

The original measurements given for the type were (in mm.): length, 89; diameter, 54; longest axis of aperture, 57.5. The two topotypes seen are slightly smaller.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
84 mm.	54.5	45	56	25	5	Rio Grande, topotype
82	52	43	51	23.5	5	" "

STROPHOCHEILUS (MEGALOBULIMUS) GRANULOSUS (Rang)

a. Typical GRANULOSUS

Pl. 12, fig. 5; Pl. 14, fig. 1; Pl. 29, fig. 4; Pl. 32, fig. 3

Helix (*Cochlogena*) *granulosa* Rang, 1831 (September), Ann. Sci. Nat., **24**, p. 53; Pl. 2 (2 figs. Interior of Brazil).

Bulimus (*Bulimus*) *granulosus* Beck, 1837, Index Moll., pt. 1, p. 53 (in part: var. *b* only). Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27; 1857, Cat. Conchyl. Suenson, p. 8.

Bulimus granulosus Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 238; 1844, *Op. cit.*, 3d Ed., **3**, p. 354. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 154. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 35, fig. 209. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 22. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 198. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 29; Atlas, Pl. 145B, fig. 1 (2 figs. Expl. of Plates, p. 20). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 304. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 27.

Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 366. A. D. Brown, 1861, Cat. Shells Coll., p. 45; 1866, *Op. cit.*, 2d Ed., p. 55. Haines, 1868, Cat. Terr. Shells Coll., p. 48. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 11. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 43 (Brazil: islet "de los Ratones" near Sa. Catharina Id.; Est. Sa. Catharina); 1872, Moluscos del Viaje al Pacífico, **1**, p. 51. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 14; 1877, *Op. cit.*, **8**, p. 604. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 212. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19** (1893–1900), pp. 89 and 197.

Bulimus haemastomus granulosus Potiez and Michaud, 1838, Gal. Moll. Douai, **1**, p. 143.

Bulimus (*Borus*) *granulosus* Albers, 1850, Die Heliceen, p. 142. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 147. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 191; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 10. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Borus granulosus Mörch, 1863, Cat. Conchyl. Lassen, p. 4.

Strophocheilus (*Borus*) *granulosus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 20; Pl. 6, fig. 33 (after Reeve; not a copy of Rang's type figure); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Helix oblonga Férussac, 1823, Hist. Nat. Moll. Terr. Fluv., Atlas, Pl. 145 B, fig. 1 (2 figs. No name on Plate; name on cover of Livr. 21, according to Kennard, 1942, Proc. Mal. Soc. London, **25**, pt. 1, p. 16). Not of O. F. Müller, 1774.

Bulimus haemastomus "variété granuleuse" Lesson, 1832 (May), Centurie Zoologique, (1830), p. 223; Pl. 77 (in part: the animal only. Brazil: Est. Sa. Catharina).[1]

Bulimus haemastomus var *sanctae-catharinae* Lesson, 1831 (December), Voy. Coquille, Zool., **2**, pt. 1, p. 320 (in part: the animal only; with reference to Centurie Zoologique, Pl. 77, perhaps from a proof sheet).

Bulimus haemastoma Mrs. M. E. Gray, 1859, Figures of Moll. Animals, **2**, Pl. 300, fig. 15; *Op. cit.*, **4**, p. 58 (copy of Lesson's fig. of 1832). Not of Scopoli, 1786.

Rang's type of *H. granulosa*, now at the Paris Museum (E. Fischer, *in litt.*, 1946), is shown in Pl. 32, fig. 3.

Specimens Examined. BRAZIL: several without definite locality (A.M.N.H.; M.C.Z.; M.U.Mich.). Est. São Paulo (Janssens, in Putzeys Collection. — M.C.Z.). Cuyabá, Est. Matto Grosso (U.S.-N.M.). Imbituba (on the coast), Est. Santa Catharina (G. de Campos — M.C.Z.). Colonia Hansa, Est. Santa Catharina (G. Ehrhardt.— D.Z.S.P.; M.C.Z.). Iguapé, Est. São Paulo (R. Krone. — M.C.Z.).

Rang (1831) cites "*Bulimus haemastomus* Lesson, Centurie Zool." (presumably from a proof sheet, as this Plate was probably not published in 1831), as a synonym of his *H. granulosa*, but this is only partly correct. As d'Orbigny (1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 297) pointed out, the animal figured and described by Lesson was that of *S. granulosus* (Rang); but the shell he drew with it was that of *S. oblongus*, as shown by the narrow spire, the pointed summit, the non-saccate left base of the body-whorl, and the shape of the aperture. The figure was half-size, which gives for his specimen: length, 120 mm.; greatest width, 62 mm.; the aperture, 70 by 28 mm.; no shell of such dimensions is known for *S. granulosus*.

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[1] The dates of Lesson's two publications are doubtful. I have followed C. D. Sherborn (1922, Index Anim., II, pt. 1, Bibliography, p. lxxx) for the "Centurie"; and C. D. Sherborn and B. Woodward (1906, Ann. Mag. Nat. Hist., (7), **17**, p. 336) for the "Voy. Coquille." I am not satisfied that either date is correct.

S. granulosus is medium-sized (81 to 106 mm. long), light, moderately thick, solid, somewhat translucent. Shell elongate-elliptical, strongly flattened dorso-ventrally, widest about mid-length. Spire slightly more tapering than base, about one-fifth of the total length, with bluntly pointed summit; first nepionic whorl depressed. Whorls flattened-convex, with shallow sutures; that of body-whorl much more oblique behind outer lip than preceding suture; base of body-whorl somewhat swollen, saccate to the left of columella. First nepionic whorl smooth; second with strong, broad riblets continuous from suture to suture; riblets slanting, somewhat curved, about as wide as their intervals below the suture, spreading apart down the whorl; third with similar riblets, but farther apart and more spreading, becoming obsolete toward the lower suture; penultimate and body-whorl with only weak folds below the suture, some of them extending to the base; body-whorl in addition with close-set, fine growth-striae. Granulose microsculpture fine, in distinct spiral rows on nepionic whorls; coarser but also very regularly spiral on last two whorls, fully developed close to outer lip and over base of body-whorl. Surface rough and dull. Aperture about half the total length, pear-shaped, its longer axis very oblique; base of columella well to the left of vertical axis of shell. Columella thin, with a narrow and slightly twisted fold separated from the parietal wall by an oblique depression, its inner edge evenly arched and gradually curved into the base of outer lip. Parietal wall moderately calloused, without swelling near upper end. Outer lip very oblique in profile, moderately reflexed, usually little thickened, equally wide throughout, rarely somewhat accrescent in old age (up to 4 mm. wide behind the rim). Umbilical slit very narrow or almost closed. Periostracum light brown, with more yellowish irregular streaks, usually worn off on the earlier whorls, which are then more reddish; subsutural pale band present or absent. Inside of mouth bluish-white. Parietal wall, columella and outer lip vinaceous-red or pink.

The sculpture of the nepionic whorls of S. *granulosus* is similar to that of S. *maximus*, but the riblets are farther apart and more spreading on the third whorl. Moreover, the strong granulation of the body-whorl, the elongate-elliptical outline, the strong dorso-ventral flattening, the somewhat saccate base and the oblique aperture are characteristics of *granulosus* not present in any of the forms of *maximus*.

Rang's original measurements of his H. *granulosa* were (in mm.): length, 90; width, 53; in his figure the aperture is 55 by 26 mm. Reeve's figure (1848) is 95 mm. long, 50 mm. wide, the aperture 53 by 23 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
106 mm.	62	51	60	27	5½	Colonia Hansa
102	59	50	61	26	5½	Iguapé
95	51.5	44	56.5	25	5	São Paulo
95	50.5	44	54	22	5¼	Imbituba
92.5	45	42	54.5	22.5	5¼	Brazil
88	45	39	50	22	5¼	"
86	45	40	51	23	5¼	"
81.5	41.5	38	49	19.5	5	Imbituba

Original description of H. *granulosa* (French text translated): "Testa ovata, ventricosa, compressa, tenui, longitudinaliter striato-rugosa, fulva; epiderma brunea, exilissime granulosa; apice subacuta; ultimo anfractu magno, oblique posito; apertura ovali; columella subcomplanata, purpurea; labro reflexo, purpureo, in medio præsertim calloso; intus pallido-cærulescente. Shell oval, ventricose and compressed dorso-ventrally; rather thin and longitudinally [=vertically] striate; color beneath the periostracum tawny, darker toward the summit, with whitish bands near the sutures; periostracum thick, brittle and beautifully brown; when examined carefully it bears innumerable fine granulose lines beginning on the spire and ending at the rim; this character makes it feel rough and appear shagreened. Spire almost acute; 5¼ whorls, a little rounded; body-whorl much larger than the others combined and with its suture more oblique than the preceding sutures, as in the foregoing species [H. *cantagallana*= S. *terrestris*]. Aperture oval, longer than half the length of the shell; its longer diameter a little oblique on the axis, but its plane even more oblique. Columella flattened and purplish, as is also the right margin

[=outer lip] which is callous in the middle and margined outwardly by a thick swollen rim. Inside dirty white."

b. S. GRANULOSUS ABBREVIATUS, new subspecies

Pl. 27, fig. 4

Shell shorter and relatively wider than typical *granulosus*, with broader, more rounded summit, the spire not more tapering than the base, which is somewhat less saccate to the left of the columella. Aperture relatively smaller as compared with the width of the body-whorl. Sculpture, shape of aperture, columella and color as in typical form, except that the granulation is much finer and is obsolete on the terminal portion of the body-whorl. Peristome bright pink. The spiral bands of the holotype are not due to color, but to the periostracum having been lost over spiral zones; this also occurs sometimes in typical *granulosus*.

Specimens Examined. BRAZIL: without more definite locality, holotype (M.C.Z. No. 49537) and 2 paratypes (M.C.Z. No. 175337; and D.Z.S.P.); specimens from the Charles A. Stearns Collection, received from Cuming as *granulosus*. Rio Grande, Est. São Paulo, paratype (M.C.Z. No. 62291), from the A. F. Gray Collection, poorly preserved. Est. Rio Grande do Sul, 2 paratypes (E. Garbe. — M.C.Z. No. 179231).

Measurements of Adult Shells[1]

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
77 mm.	43	38	47	20	5	Brazil, holotype
71.5	38.5	36	42	18.5	5	"
68	38	34.5	40	18	5	"
67	37.5	33.5	41	17	5	Rio Grande
66	38.5	33.5	38	17	5	Rio Grande do Sul

c. S. GRANULOSUS PARANAGUENSIS Pilsbry and v. Ihering

Pl. 5, fig. 4; Pl. 26, fig. 2; Pl. 30, fig. 4

Strophocheilus (*Borus*) *paranaguensis* Pilsbry and H. von Ihering, 1900, Proc. Ac. Nat. Sci. Philadelphia, p. 390; Pl. 11, figs. 1–2 (Brazil: Paranaguá, on the coast of Est. Paraná). Pilsbry, 1901, Man. of Conch., (2), **14**, p. 124; Pl. 16, figs. 1–2 (type); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

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[1] Paratypes, except where indicated.

I have seen the type at Ac.N.S.Phila. (No. 72646).

Specimens Examined. BRAZIL: Paranaguá, Est. Paraná, holotype (H. v. Ihering. — Ac.N.S.Phila.); also 1 adult and 1 young topotypes not seen by Pilsbry (H. v. Ihering. — U.S.N.M.). Iguapé, Est. São Paulo (H. v. Ihering. — U.S.N.M.; and A. Krone. — M.C.Z.).

This form is considerably broader in proportion to the length, with a relatively shorter and wider spire than typical *granulosus*. However, the nepionic riblets, the shape of aperture and columella, and the saccate left base of the body-whorl are as in *granulosus*, of which *paranaguensis* appears to be a fairly well-marked race. Peristome rose-colored or pinkish.

Pilsbry's measurements of the type were (in mm.): length, 92; greater diameter, 55; lesser diameter, 47; length of aperture, 62; but his figure is slightly larger and agrees better with the specimen, as shown below.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
109.5 mm.	65	57.5	67	28	5½	Paranaguá
102	61.5	50.5	63	28	5⅛	Iguapé
95	59	49	58.5	25	5¼	Paranaguá, holotype

d. S. GRANULOSUS FORELI, new subspecies

Pl. 28, fig. 3

Of the size of typical *granulosus*, but relatively narrower and with broader spire, making the shell more nearly spindle-shaped in front view. Penultimate whorl very bulging to the left side in profile, the suture of the body-whorl more slanting than usual behind the parietal edge of the outer lip (rather abnormally so in the holotype). Body-whorl granulose over the preserved patches of periostracum, but granules weaker and less regularly arranged in spiral lines than in the other races of the species. Peristome pure white, without any suggestion of pink.

Specimens Examined. BRAZIL: Punta Grossa, Est. Paraná, holotype (D.Z.S.P. No. 7984) and paratype partly covered with periostracum (M.C.Z. No. 179290); both sent by Dr. Oliverio M. de Oliveira Pinto;[1] found dead and weathered.

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[1] The specimens had been labelled as a new species, but not described, by the late H. v. Ihering. His manuscript name has been retained.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
101 mm.	53	45	56.5	26	5½	Holotype
97.5	47.5	40	52	23	5½	Paratype

STROPHOCHEILUS (MEGALOBULIMUS) PROCLIVIS (v. Martens)

Pl. 19; fig. 5; Pl. 28, fig. 2

Bulimus proclivis v. Martens, 1888 (April), Sitzungsber. Ges. Naturf. Fr. Berlin, p. 64 (Brazil: Taquara do Mundo Novo, Est. Rio Grande do Sul, type locality; also Rödersberg, Est. Rio Grande do Sul).

Strophocheilus (*Borus*) *proclivis* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 195.

Bulimus lacunosus v. Martens, 1868, Malak. Blätt., **15**, p. 177 (Brazil: Rödersberg; referred to *S. proclivis* by v. Martens in 1888). Not of d'Orbigny, 1835.

Bulimus (*Borus*) *iheringi* Clessin, 1888 (August or September), Malak. Blätt., (2), **10**, p. 167 (Brazil: Taquara do Mundo Novo, Est. Rio Grande do Sul).

Strophocheilus (*Borus*) *iheringi* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 122; Pl. 20, fig. 62 (after H. v. Ihering's photograph of a shell from the original lot); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

The synonymy of *proclivis* and *iheringi* was recognized by Pilsbry, both names being based on shells obtained together in the same locality by H. v. Ihering. Although published the same year, *proclivis* appeared several months before *iheringi*. The type of *proclivis* should be at the Berlin Museum. I do not know where that of *iheringi* is located at present.

Specimens Examined. BRAZIL: Taquara do Mundo Novo, Est. Rio Grande do Sul, topotype (M.N.H.Chic.). Est. Rio Grande do Sul, without more definite locality, though possibly also a topotype (received from H. Rolle as "*proclivis*=*iheringi*". — M.U.Mich.).

Shell medium-sized (89 to 93 mm. long), solid, moderately thick, nearly opaque, elongate spindle-shaped in outline, the greatest width near mid-length, the spire scarcely more tapering than the base, distinctly flattened dorso-ventrally. Body-whorl rather narrow, only slightly more ventricose than penultimate whorl, about three-fourths of total length in front view, not saccate at left side of base. Summit bluntly pointed; earliest whorls somewhat depressed; succeeding whorls flattened convex, with shallow sutures; suture of body-whorl from the back much more slanting than preceding suture. First one and a half nepionic whorls smooth; then appear strong, narrow, slightly slanting, somewhat curved riblets, extending from suture to suture, about as wide as their intervals below the suture, but spreading apart farther down the whorl; from the third whorl on, riblets lower and much more spaced, fading downward before reaching the lower suture; penultimate and body-whorl with weak subsutural folds and fine, crowded growth-striæ. Granulose microsculpture not preserved in the two worn specimens seen. Aperture about half the total length, semi-elliptical, with very oblique longer axis. Columella thin, straight, slanting, its base well to left of vertical axis of shell, its inner edge with a weak fold above, rather abruptly curved into base of outer lip. Parietal wall more or less calloused, without upper swelling. Outer lip moderately reflexed and thickened, equally wide throughout, accrescent (rim 6 mm. wide in topotype). Umbilical slit completely closed. Periostracum lost in the specimens seen, which are yellowish-brown, with an ill-defined subsutural pale band. Inside of mouth bluish-white. Parietal wall and columella pinkish; outer lip roseate in topotype, white with a trace of pink toward base in the other shell.

S. proclivis differs from its near relative *S. granulosus* in the more attenuate, not appreciably saccate base of the body-whorl, the straighter columella, and the stronger, somewhat more crowded nepionic riblets. The nepionic sculpture is intermediate between that of *S. granulosus* and that of *S. sanctipauli.* The more attenuate base, the spindle-shaped outline, the relatively wider spire and more bulging penultimate whorl differentiate *proclivis* from *sanctipauli,* at least in the limited material studied.

v. Martens gave the following measurements for the type of *proclivis* (in mm.): height, 89; greater width, 42; lesser width, 35; aperture, 45 long, 34 wide with and 25 wide without the peristome. Clessin gave for *iheringi* (in mm.): length, 90; diameter, 43; length of aperture, 44.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
93 mm.	45.5	36	48	21	5½	Taquara, topotype
92.5	44.5	38	47	21	5½	Est. Rio Grande do Sul

Subgenus MICROBORUS Pilsbry

Strophocheilus subg. *Borus* sect. *Microborus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6 (with description; for four described species). Type by original designation: *Bulinus lutescens* King and Broderip, 1832.

Microborus was briefly defined by Pilsbry as follows: "*Strophocheilus lutescens* and its allies of the eastern coast are not related to this series [*viz., Chiliborus*]. They appear to be a southern group of *Borus* which may be segregated as section *Microborus*, related to the typical *S. oblongus* group, from which they differ mainly by the small size and weak sculpture of the early whorls." He included four species: *S. globosus* (v. Martens), *S. lutescens* (King and Broderip), *S. d'orbignyi* (Döring), and *S. cordilleræ* (Döring).

Like the other subgenera of *Strophocheilus, Microborus* seems to be best characterized by the peculiar sculpture of the nepionic whorls. This consists of fine, close-set, vertical raised lines, cut by many spiral impressed lines into minute granules. Such granulation is characteristic of specimens of *S. lutescens* and *S. d'orbignyi* with well preserved summit, particularly in young shells. It is, however, not present in *S. globosus,* in which instead the nepionic whorls bear only low, spaced, vertical, fold-like ribs, essentially like those of many species of *Megalobulimus*. Notwithstanding its small size, I have therefore removed *S. globosus* from *Microborus* to its present position in *Megalobulimus*. *S. cordilleræ* is not known to me, but presumably has the nepionic sculpture of the subgenotype.

Synopsis of Species Studied

1. Shell 23 to 30 mm. long, very broadly elliptical, of 4¼ to 4½ whorls, with broadly rounded summit. Nepionic whorls mostly covered with very fine, regular, crowded, vertical raised lines, decussated by spiral engraved lines into minute granules; later whorls also mostly granulose. Columella short and broad, slightly arched. Outer lip moderately thick, little reflexed, rarely accrescent. Umbilical slit narrow or almost closed. *S. lutescens.*

2. Shell 28 to 36 mm. long, more elongate elliptical than *lutescens,* of 4⅓ whorls, with broadly rounded summit. Nepionic whorls partly covered with very fine, irregular, incomplete, crowded, vertical raised lines, cut into irregular granules by spiral engraved lines; granulation present also, but very weak on later whorls. Columella short and broad, slightly arched. Outer lip relatively thicker than in *lutescens* and frequently accrescent in old age. Umbilical slit as a rule narrowly rimate. *S. d'orbignyi.*

All known species of *Microborus* are from Uruguay and northern Argentina, to which area this group is restricted.

Pilsbry recently described *Megalobulimus* (*Microborus*) *incarum*

(1944, The Nautilus, **58**, p. 29; Pl. 1, figs. 8–9), from Huaraz, Peru, at an altitude of 3,000 to 3,200 m. (collected by W. Weyrauch), far outside the known range of *Microborus*. The Museum of Comparative Zoölogy had previously received from the same collector several lots of this form, including some 80 specimens collected at Huaraz with the types of *incarum*. Owing to the peculiar sculpture of the nepionic whorls, I had placed these shells in the family Bulimulidæ, not in *Microborus*. This sculpture, which Pilsbry describes as a "fine, shallow, slightly irregular radial corrugation," is, in specimens where it is well preserved, like that of *Thaumastus* and some other Bulimulidæ. It may be noted also that *incarum* lacks the very broadly rounded summit and depressed first whorl of *Microborus*. The original lot, from Huaraz, consisted of dead shells only. More recently, however, Dr. Weyrauch obtained living, hibernating specimens of the same snail at Tapococha near Fortaleza, 3,500 m., Peru. At my request some of these were dissected by Mr. Charles B. Wurtz, who reports (*in litt.*, 1947) that the anatomy is as in Bulimulidæ.[1]

STROPHOCHEILUS (MICROBORUS) LUTESCENS (King and Broderip)

Pl. 6, fig. 7; Pl. 27, figs. 2, 3

Bulinus lutescens King and Broderip, 1832 (July), Zool. Journ., **5**, (1831), No. 19, p. 340 (Uruguay: Maldonado [Gorrití]).

Bulimus lutescens Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 156. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 49. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 200. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 325. Hupé, 1854, in Gay, Hist. Fis. Pol. Chile, Zool., **8**, p. 107. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Pfeiffer, 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 186; Pl. 54, figs. 8–9 ("southern Chile," erroneous locality); 1859, Monogr. Helic. Viv., **4**, p. 383. A. D. Brown, 1861, Cat. Shells Coll., p. 46. Haines, 1868, Cat. Terr. Shells Coll., p. 51. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 29. Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 44 (Uruguay: Montevideo). Paetel, 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 45; 1877, *Op. cit.*, **8**, p. 605. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 213. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 89, 201, and 318. Corsi, 1900, An. Mus. Nac. Montevideo, **2**, pt. 16, p. 406, figs. 24–25 (in part: Uruguay: Puntas de Larayan, Dept. de la Florida).

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[1] The anatomy was described by Mr. Wurtz in a recent paper, where *incarum* is made the type of a new subgenus of *Bulimulus*. Mr. Wurtz informs me that Dr. Pilsbry compared the Tapococha shells with the types of his *incarum* and pronounced them identical, agreeing at the same time that the species belongs in Bulimulidae. I am of the opinion that *Bulimulus incarum* (Pilsbry) is identical with *Bulimus crenellus* Philippi (1867), although Mr. Wurtz disagrees with this view (C. B. Wurtz, 1947, The Nautilus, **61**, pp. 11–16; figs. 1–9).

Bulimus (*Scutalus*) *lutescens* Albers, 1850, Die Heliceen, p. 160. Pfeiffer, 1856, Malak. Blätt, **2**, (1855), p. 152.

Bulimus (*Bulimus*) *lutescens* Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27.

Orthalicus (*Scutalus*) *lutescens* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 158.

Bulimus (*Borus*) *lutescens* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 23. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 225.

Strophocheilus (*Borus*) *lutescens* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 36; Pl. 9, fig. 46 (specimen); Pl. 12, fig. 59 (after Reeve's *nucleus*); 1896, *Op. cit.*, (2), **10**, p. 197; 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus lutescens Pilsbry and Rush, 1896, The Nautilus, **10**, p. 78 (Uruguay: Gorriti Id., Maldonado Bay). Felippone and Barettini, 1938, Bol. Servicio Oceanográfico, Montevideo, **1**, pt. 1, p. 55 (Uruguay: common, particularly in Dept. Maldonado and on Gorrití Id.).

Strophocheilus (*Borus, Microborus*) *lutescens* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6.

Megalobulimus lutescens Parodiz, 1946, Notas Mus. La Plata, **11**, Paleont. No. 92, p. 306 (Uruguay: Punta Chaparro, in late Tertiary, post-Pampean deposits).

Bulimus (*Borus*) *lutecens* Döring, 1876, Bol. Ac. Nac. Cienc. Exact. Córdoba, **2**, pt. 3, p. 334; 1877, Periódico Zoológico, 2, pt. 4, p. 253 (misspelling of *lutescens*).

Bulimus (*Borus*) *latescens* H. v. Ihering, 1894, Arch. f. Naturgesch., **60**, pt. 1, p. 38 (Brazil: Bolassa, Est. Rio Grande do Sul, subfossil in old Indian kitchen-middens; misspelling of *lutescens*).

Bulinus nucleus Sowerby, 1833 (between May 17 and July 12), Conchol. Illustr., *Bulinus*, fig. 33 of Pt. 31 (with name in accompanying printed list; "Straits of Magalhaens," erroneous locality; probably based on a shell from the type lot of *B. lutescens*).

Bulimus (*Bulimus*) *nucleus* Beck, 1837, Index Moll., pt. 1, p. 52.

Bulimus nucleus Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 158. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 17, fig. 99 (Uruguay: locality here given correctly as Maldonado near Montevideo). Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 37; Atlas, Pl. 139, figs. 15–16 (Expl. of Plates, p. 20). Pfeiffer, 1852, Zeitschr. f. Malak., **9**, p. 100 (says *B. lutescens* King and Broderip is the same, according to authentic specimens at the British Museum). Chenu, 1852, Illustrations Conchyliologiques, **4**, Pl. 8, fig. 17. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 158.

Bulimus lutescens var. *nucleus* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 213.

The type of *B. lutescens* may be at the British Museum, as well as that of Sowerby's *B. nucleus*, which appears to have been a shell from the type lot of *lutescens*.

Specimens Examined. URUGUAY: Maldonado, Gorrití Island, several adult and young shells, at various stages, also eggs (W. H. Rush. — A.M.N.H.; U.S.N.M.; M.U.Mich.). Cape Polonia (H. M. Smith. — U.S.N.M.). Near Montevideo (Safford. — U.S.N.M.; M.C.Z.; M.U.-Mich.). Rocha (A. Carcelles. — M.C.Z.). Punta Canelos, near Montevideo (S. Olea. — U.S.N.M.). Isla de Lobos (F. Felippone. — U.S.N.M.). Punta Carretas (F. Felippone. — U.S.N.M.). Cerro Largo, Jaguaron Chico, 1 normal and 1 abnormal shell (F. Felippone. — U.S.N.M.). Puerto de la Paloma, Salto (M.N.H.Chic.).

Shell in fresh condition thin, translucent, pale dirty-yellowish, somewhat darker on early whorls. Only 4¼ to 4½ whorls in adult; penultimate whorl including part of nepionic shell. Summit very bluntly rounded; first whorl depressed. Characteristic sculpture visible only on very young or on fresh, perfect, adult shells (youngest seen, newly hatched, 9 mm. long); subfossil shells have lost all trace of it. First and most of second whorls smooth, except for very weak, short, flat, much spaced, vertical welts immediately below the suture of the second, producing a slightly wavy appearance of the suture. Third whorl densely covered with extremely fine, very regular, vertical raised lines (too fine to be called riblets), extending from suture to suture, cut into minute granules by numerous fine, engraved spiral lines; succeeding whorls, as far as outer lip, with coarser, irregular growth-striæ, somewhat stronger below the suture, which they crenulate very lightly, and with more pronounced granulation. At all ages, basal half of terminal whorl, below periphery, smooth, without granulation. Columella short, much expanded, slightly arched and passing by a very even curve into base of outer lip. Umbilicus a narrow slit or almost completely closed. Outer lip moderately thick, little expanded, very rarely somewhat accrescent (widest lip seen, 1.5 mm. wide behind the rim); brownish-yellow to pale orange, but usually faded to white.

A dwarfed specimen, from Cerro Largo (F. Felippone. — U.S.N.M.), 22.5 mm. long, 19 mm. wide, aperture 17.5 by 8.5 mm., is evidently an abnormal, diseased *S. lutescens*, of which it has the sculpture, there being traces of granulation on the body-whorl. It consists of not fully 4 whorls, the last unusually bulging, with a thickened outer lip, more expanded than usual. The columella is distorted.

A set of eggs from Gorrití Island, at U.S.N.M., are 7.8 to 9 mm. long, 6 to 6.8 mm. wide.

King and Broderip gave the original measurements of *lutescens* as: long. 1⅛ inch [=28.5 mm.]; lat. 11/16 inch [=17.4 mm.]. The shell figured by Sowerby as *nucleus* was 26 mm. long, 17.5 mm. wide, aperture 15.5 by 8 mm.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
34 mm.	21.5	20	21	11.5	4½	Cerro Largo
30	20	18	19.5	10	4½	Isla de Lobos
29.5	18	17	17.5	9	4½	Punta Carretas
29	18.5	17	18	9	4½	Cape Polonia
27.5	17	16	16.5	8.5	4⅜	Gorrití Island
26	17	15.5	17	9	4⅜	Montevideo
25.5	16	15	15.5	8.5	4⅜	Gorrití Island
23.5	15.5	15	14	8	4¼	" "
23	15	14	14	7.5	4¼	" "

It may be noted that the smaller the shell, the more ventricose it becomes.

STROPHOCHEILUS (MICROBORUS) D'ORBIGNYI (Döring)

Pl. 12, fig. 4; Pl. 32, figs. 6, 7

Bulimus (*Borus*) *d'orbigni* Döring, 1876, Bol. Ac. Nac. Cienc. Exact. Córdoba, **2**, pt. 3, p. 336, with var. *maxima* and var. *minima* (Argentina: "interior of Patagonia"); 1877, Periódico Zoológico, **2**, pt. 4, p. 255; 1878, Jahrb. D. Mal. Ges., **5**, p. 135.

Borus d'orbignyi Döring, 1881, Informe Com. Cientif. Exped. Río Negro, Zool., p. 64; Pl. 1, fig. 4 (Argentina: Río Sauce Chico, near Fuerte Argentino, Terr. Río Negro; snail found alive. Jaw).

Strophocheilus (*Borus*) *lutescens* var. *dorbignyi* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 126; Pl. 24, fig. 1 (after Döring).

Strophocheilus (*Microborus*) *dorbignyi* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6 (Argentina: Sierra Ventana near Bahía Blanca).

Borus orbignyi Petit, 1883, Jl. de Conchyl., **31**, p. 272 (emendation of *d'orbignyi*).

Bulimus orbignyi Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215. Not *Bulimus orbignyi* Pfeiffer, 1846.

Helix (*Cochlogena*) *nucleus* d'Orbigny, 1835, Mag. Zool., **5**, Class 5, No. 61, p. 14 ("Patagonia"). Not *Bulinus nucleus* Sowerby, 1833.

Bulimus nucleus d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 305 (Argentina: Bahía Blanca, 39°S).[1] Döring, 1874, Periódico Zoológico, **1**, pt. 2, p. 114. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 214.

Bulinus nucleus Darwin, 1840, Zoology Voyage Beagle, **1**, p. 9 (Argentina: in the bone beds of Bahía Blanca). F. Ameghino, 1881, La Antigüedad del Hombre en el Plata, p. 91; 1915, Obras Completas y Correspondencia Científica, **3**, p. 486.

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[1] At least one later author credits d'Orbigny also with the locality San Blas; but d'Orbigny states expressly that he did not find his *B. nucleus* there.

Bulimus (*Borus*) *nucleus* Strobel, 1874, Materiali Malacostatica Argentinia Meridionale, p. 20 (Argentina: Bahía Blanca). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Bulimus (*Borus*) *lutescens* var. *australis* v. Martens, 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 23 (Argentina: Bahía Blanca). Not *Bulimus australis* Bruguière, 1792.

Bulimus lutescens var. *australis* Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 213.

Strophocheilus (*Borus*) *lutescens* var. *australis* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 36; Pl. 9, figs. 46–48 (specimens) (Argentina: Bahía Blanca); 1896, *Op. cit.*, (2), **10**, p. 194 (jaw); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus (*Borus*) *lutescens* Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 46. Not of King and Broderip, 1832.

Strophocheilus lutescens Carcelles, 1945, Physis, Buenos Aires, **20**, No. 55, p. 44 (shells from "Pampean" deposits at Bahía Blanca).

Döring's type of *d'orbignyi* is possibly at the Zoological Museum of the University of Córdoba, Argentina. v. Martens' type of *australis* should be at the Berlin Museum.

In the Zoological Record for 1876 (Moll., p. 46) v. Martens recognized that his *B. lutescens* var. *australis* was a synonym of *B. d'orbignyi* Döring. Both names were published the same year, but v. Martens' name is unacceptable, being antedated by a homonym.

Specimens Examined. ARGENTINA: Villarino, Dept. Villarino (W. J. Eyerdam. — M.C.Z.). Hacienda Ducous, 15 kilom. northwest of Pique, Dept. Saavedra (W. J. Eyerdam. — M.C.Z.). Bahía Blanca, several adult and a few young specimens, some with periostracum (W. B. Barrows. — U.S.N.M.; M.C.Z.; M.U.Mich. Max Birabén. — M.C.Z.).

Pilsbry (1926) first recognized that *d'orbignyi* is a valid species, not a variety of *lutescens*, stating that it differs chiefly "by lacking the fine granulation of *lutescens*, or showing only faint traces of it in the most perfect specimens." In this view he is no doubt correct. The following differences appear to be constant. (1) The raised vertical lines of the latter part of the nepionic shell are at first very irregular, incomplete or broken up and eventually present only below the suture; combined with the spiral granulation, this produces a somewhat vermiculate surface, particularly in older shells, where the granules are mostly worn off. (2) The granules of the post-nepionic whorls are very weak and irregular, scarcely to be detected when the periostracum is lost; when well preserved, they are found also, however, over the basal portion of the body-whorl, below the periphery. (3) The outer lip is thicker and frequently produces accretions in old age; in one shell from Bahía Blanca the lip is nearly 5 mm. wide behind the rim. When preserved the periostracum is pale olivaceous-brown, with some darker vertical streaks. The peristome is usually white, but this may be due to bleaching, as in a few specimens it is somewhat yellowish and in two for the greater part bright orange. In outline the shell is relatively higher than *S. lutescens*, more elongate-elliptical. The umbilicus is usually more openly rimate than in *lutescens*.

The measurements of Döring's types of *d'orbignyi* are given below, with the original description.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
36 mm.	22	21.5	22	11.5	4⅓	Bahía Blanca
34	20	18.5	20.5	10.5	4⅓	" "
32.5	20	18.5	19.5	10.5	4⅓	" "
30.5	17.5	16	18	9.5	4⅓	" "
29	18	17	17.5	9	4⅓	" "
28	19.5	16.5	18	10	4⅓	" "

Original description (Spanish text translated) of *B. d'orbignyi:* "T. ovata, crassa, subumbilicata, longitudinaliter substriata, fulva vel albida; spira brevi, apice obtusa, anfr. 4; sutura lævigata; apertura ovali; labro crasso albido vel rufescente. Long. 36 mm.; lat. 26 mm. (d'Orbigny's measurements). Var. *a. maxima.* Long. 35 mm.; lat. 23 mm.; var. *minima.* Long. 30 mm.; lat. 20 mm. Var. *b.* margine dextro peristomatis extra late incrassato, paulum labiato (after Strobel). I have received a white specimen of this species collected by Sr. D. F. P. Moreno during his latest trip in the interior of Patagonia which measures: Long. 30 mm.; lat. 22 mm.; ap. 18 mm. longa, 16 mm. lata. Compared with our type of the foregoing species, *B. nucleus* [=*S. lutescens*], it is somewhat more elongate, less ventrose; the striation is coarser, distinctly visible; the aperture somewhat narrower."

STROPHOCHEILUS (MICROBORUS) CORDILLERAE (Döring)

Bulimus (*Borus*) *lutecens* var. *cordillerae* Döring, 1876, Bol. Ac. Nac. Cienc. Exact. Córdoba, **2**, pt. 3, p. 335 (Argentina: Sierra de Achala near Córdoba); 1877, Periódico Zoológico, **2**, pt. 4, p. 254.

Bulimus (*Borus*) *lutescens* var. *cordillerae* Döring, 1878, Jahrb. D. Mal. Ges., **5**, p. 135.

Strophocheilus (*Borus*) *lutescens* var. *cordillerae* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 125; 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus (*Microborus*) *cordillerae* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 7.

Borus rimanni Frenguelli, 1918, Bol. Ac. Nac. Cienc. Córdoba, **23**, pt. 2, p. 228; with fig. on p. 229 (apparently a new name for *Borus lutescens* var. *cordillerae* Döring, which is given as a synonym. Argentina: fresh shell figured from Cerro de Uritorco de Capilla del Monte); 1924, *Op. cit.*, **26**, pts. 2–4, p. 406, figs. 1–2 (dead specimens from old Indian burying grounds on the Río San Roque, Sierra Chica de Córdoba, Dept. Punilla, Argentina).

Borus rimanni var. *fossilis* Frenguelli, 1918, Bol. Ac. Nac. Cienc. Córdoba, **23**, pt. 2, p. 228 (Argentina: Potrero Garay in the Sierra de Alta Gracia; presumably subfossil).

Döring's type of *cordilleræ* is possibly at the Zoological Museum of the University of Córdoba, Argentina, where that of Frenguelli's *rimanni* and that of *fossilis* may be also.

I have not recognized this form in the rather scanty material seen from Argentina. It seems to be closer to *lutescens* than to *d'orbignyi*, the supposed differences from *lutescens* being very weak and possibly only of subspecific value. Pilsbry (1926) synonymized *rimanni* with *cordilleræ*.

Original description (Spanish text translated) of *B. lutescens* var. *cordilleræ:* "Long. 38 mm.; lat. 25 mm.; ap. c. perist. 20 mm. longa; 15 mm. lata. T. ovata, intense lutescens, obsolete striata, sublævigata; sutura subcrenulata, peristoma breviter reflexum, intense aurantiacum. The chief difference [from typical *lutescens*] lies in the absence of the spiral lines, of which weak traces are to be seen, but only on the first whorls. The entire peristome is bright orange-red."

STROPHOCHEILUS (MICROBORUS ?) SANCTI–JOSEPHI Maury

Strophocheilus sancti-josephi Maury, 1935, Amer. Mus. Novit., No. 764, p. 7, figs. 8–9 (Brazil: Fazenda São José, Municipio of Itaborahý, Est. Rio de Janeiro; fossil in strata "probably Miocene, with an upper limit of Pliocene").[1]

The holotype and only known specimen is at Am. Mus. N.H. in New York (No. 24241).

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[1] In 1929 (Serviço Geol. Miner. Brasil, Bol. No. 33, p. 4), the late Miss Maury reported from the same locality Itaborahý, supposedly in Tertiary strata, a fragmentary mold of the basal part of a rather large snail tentatively referred to *Strophocheilus*. Nothing further is known of this fossil.

Copy of original description: "Shell rather large, exceeding in size any of the associated land mollusks in the collection from Fazenda São José, and broadly ovate in form. The early whorls are not preserved, but the shell when entire included about seven whorls. The surface is much worn and eroded, but in a few small areas fine, oblique wrinkles of growth are preserved and the entire surface was probably similarly striated. The aperture is narrowly oval. Estimated length of complete shell 45 mm., greatest width 27 mm.; length of aperture measured obliquely 24 mm., greatest width of aperture 10 mm."

The specimen is too poorly preserved to trace its probable relations. Both the nepionic sculpture and aperture being unknown, its position in Strophocheilidae is uncertain. The small size and broadly ovate shape may possibly indicate *Microborus.*

Subgenus CHILIBORUS Pilsbry

Strophocheilus subg. *Chiliborus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6 (with description; for five described species, one of them included doubtfully). Type by original designation: *Bulinus chilensis* Sowerby, 1833.

The characteristic raised spiral striation of the nepionic whorls is variously developed and often completely weathered away or worn off. It is most pronounced and very crowded in *S. chilensis* and *S. pachychilus,* where it begins at once on the first whorl. It is finer, but also crowded in *S. rosaceus,* where in perfect specimens, which are rare, it may also be traced to the start of the first whorl. In *S. bridgesii* the lines are far apart, but start likewise on the first whorl. The crenulation below the suture is very strong in *S. rosaceus,* weaker in *S. chilensis* and even more so in *S. pachychilus;* but in all three species it starts as a wavy suture on the second nepionic whorl. In *S. bridgesii* the suture is scarcely or not crenulated and it is perfectly even on the nepionic shell.

The subgenus *Chiliborus* appears to be restricted to central Chile, all reliable localities being situated between 28° and 43° 30′ S. lat. (from Huasco to Chiloë). The locality Cocapata, Bolivia, I have been unable to trace; moreover, the larger form of *S. rosaceus,* which Reeve (1848) mentioned as occurring there, was evidently the shell later described by Pfeiffer (1855) as *Bulimus cocapatensis.* This is an unfigured and unrecognized species, which from the description appears to have been a *Megalobulimus,* not a *Chiliborus.* The supposed occurrence of *S. rosaceus* in Peru was no doubt due to a misidentification, as I have stated under *S. capillaceus.*

All the known localities are on the coast and it is not known how far inland any of the species extend. These snails are evidently long-lived. King and Broderip (1832) noted that some of the specimens on which they described *S. rosaceus* were brought to England alive, but in a dormant state; some lived nearly two years at least. During the winter or dry season, they close the aperture with an epiphragm, which E. A. Smith (1884) described for *S. rosaceus* as tough and horny, as thick as the operculum of a *Viviparus*.

Synopsis of Species

The shape of the peristome divides *Chiliborus* into two groups.

A. Peristome as usual in *Strophocheilus*. Aperture semi-elliptical. Outer lip moderately arched in upper portion, which joins the parietal wall at a very sharp angle (about 50° or less). Parietal wall longer than columella. Body-whorl very slightly flattened or descending behind upper margin of outer lip.

1. Medium-sized (44 to 67 mm. long), elongate-ovate, strongly crenulated at the sutures; surface very uneven, with low, irregular, coarse vertical folds. Granulation well marked, also on body-whorl (unless worn off). Summit very obtuse; first nepionic whorl depressed. *S. rosaceus*, with subsp. *seneri*.

B. Peristome with outer lip strongly arched in upper portion, which joins the parietal wall nearly at a right angle (more than 50°). Aperture nearly semi-circular. Parietal wall shorter than columella. Body-whorl strongly flattened and descending behind upper margin of outer lip. The peristome is somewhat similar to that of *Neopetræus* (Bulimulidæ).

2. Small (26 to 41 mm. long), elongate-ovate, with fairly regular crenulation at the sutures; surface almost even, with fine vertical growth-striæ. Granulation well-marked, also on body-whorl. Summit moderately obtuse; first nepionic whorl a little raised. Outer lip little or not accrescent. *S. chilensis*.

3. Small (33 to 38 mm. long), elongate-ovate, with irregular to obsolete crenulation at the sutures; surface almost even, with fine vertical growth-striæ. Granulation very fine, relatively weak or sometimes obsolete on the body-whorl. Summit moderately obtuse; first nepionic whorl a little raised. Outer lip strongly accrescent in old age. *S. pachychilus*.

4. Much smaller (19 to 24 mm. long), narrowly ovate; sutures not appreciably crenulated; surface even, with minute vertical growth-striæ. Granulation very fine, often difficult to see, in spaced spiral

rows on the body-whorl. Summit moderately obtuse; first nepionic whorl well raised. Outer lip not accrescent in old age. *S. bridgesii.*

Strophocheilus (Chiliborus) rosaceus (King and Broderip)

a. Typical rosaceus

Pl. 10, fig. 3; Pl. 15, fig. 1; Pl. 16, fig. 4; Pl. 25, fig. 3; Pl. 29, fig. 2

Bulinus rosaceus King and Broderip, 1832 (July), Zool. Journ., **5**, (1831), No. 19, p. 341 (animal. Chile). Gray, 1839, Zool. Beechey's Voy. Blossom, Moll. Anim., p. 145; Pl. 38, fig. 15. Sowerby, 1842, Conchol. Manual, 2d Ed., pp. 88 and 302; fig. 282 of unnumbered Plate; 1852, *Op. cit.*, 3d Ed., pp. 89 and 325; Pl. 14, fig. 282.

Bulinus rosasceus Sowerby, 1833 (March 15), Conchol. Illustr., *Bulinus*, fig. 5 of Pt. 22 (with name in accompanying printed list. Chile: Valparaiso). Name corrected to *rosaceus* in the revised list of 1841.

Helix (*Cochlogena*) *rosacea* d'Orbigny, 1835, Mag. Zool., **5**, Class 5, No. 61, p. 14 (Chile: Valparaiso).

Bulimus (*Bulimus*) *rosaceus* Beck, 1837, Index Moll., pt. 1, p. 52. Anton, 1839, Verzeichniss Conch. Samml., p. 46. Mörch, 1850, Cat. Conch. Yoldi, pt. 1, p. 27; 1857, Cat. Conchyl. Suenson, p. 8.

Bulimus rosaceus Jay, 1836, Cat. Rec. Shells, 2d Ed., p. 41. Potiez and Michaud, 1838, Gal. Moll. Douai, **1**, p. 153; Pl. 15, figs. 3–4. Deshayes, 1838, in Lamarck, Hist. Nat. An. Sans Vert., 2d Ed., **8**, p. 269 (in part). Jay, 1839, Cat. Rec. Shells, 3d Ed., p. 57. A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 20. Deshayes, 1844, in Lamarck, Hist. Nat. An. Sans Vert., 3d Ed., **3**, p. 365 (in part). Catlow and Reeve 1845, Conchologist's Nomenclator, p. 160. Porro, 1846, Coll. Mus. Mediol., Moll. Terr. Fluv., p. 14. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 15, figs. 87*a-b* (Chile: fig. *a*, Valparaiso; fig. *b*, Huasco; a larger form is said to occur at Cocapata, Bolivia[1]). Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 52 (Chile: Coquimbo). Mörch, 1850, Cat. Conchyl. Kieruff, p. 7. Jay, 1850, Cat. Rec. Shells, 4th Ed., p. 208. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 36 (in part); Atlas, Pl. 139, figs. 20–21 only (Expl. of Plates, p. 20). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 317. Chenu, 1853, Illustrations Conchyliologiques, **4**, Pl. 8, fig. 18. Hupé, 1854, in Gay, Hist. Fis. Pol. Chile, Zool , **8**, p. 106 (in part). H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. Pfeiffer, 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 250; Pl. 68, figs 4–5; 1859, Monogr. Helic. Viv., **4**, p. 380. Mrs. M. E. Gray, 1859, Fig. Moll. Animals, **1**, Pl. 73, fig. 10 (copy of d'Orbigny's fig. of var. *major*); *Op. cit.*, **4**, p. 15. A. D. Brown, 1861, Cat. Shells Coll., p. 48; 1866, *Op. cit.*, 2d Ed., p. 60. Haines, 1868, Cat. Terr. Shells Coll., p. 55. Pfeiffer, 1868, Monogr.

[1] This larger form was evidently *Bulimus cocapatensis* Pfeiffer, 1855, an unrecognized species which I have included in *Megalobulimus*.

Helic. Viv., **6**, p. 24. Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 43 (Chile: Valparaiso); 1872, Moluscos Viaje al Pacífico, **1**, p. 53. Paetel, 1873, Cat. Conch.-Samml., p. 99. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 37; 1877, *Op. cit.*, **8**, p. 605. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 216. Kew, 1893, The Dispersal of Shells, p. 112. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 89 and 198.

Bulimus (*Scutalus*) *rosaceus* Albers, 1850, Die Heliceen, p. 160. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 152.

Bulimus (*Borus*) *rosaceus* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 21 (Chile: Chiloë; also supposedly from "Peru"). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 121. E. A. Smith, 1884 (October), Proc. Zool. Soc. London for 1884, p. 280 (Chile: Valparaiso). Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119.

Borus rosaceus Mörch, 1863, Cat. Conchyl. Lassen, p. 4. Standen, 1917, Jl. of Conchol., **15**, p. 159 (egg). Lamy, 1929, Jl. de Conchyl., **73**, pt. 3, p. 195 (egg).

Strophocheilus (*Borus*) *rosaceus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 33; Pl. 5, fig. 27 (after Reeve's fig. 87*b*); 1896, *Op. cit.*, (2), **10**, p. 197; 1902, *Op. cit.*, (2), **14**, Classification, p. v. Germain, 1933, Publ. Mus. Hist. Nat. Paris, No. 3, p. 46.

Bulimus rosaceus Dautzenberg, 1896, Actes Soc. Scientif. Chili, **6**, p. lxvi (Chile: Quilpue).

Strophocheilus (*Chiliborus*) *rosaceus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6.

Bulimus rosaceus var. *major* d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 304; Pl. 34, figs. 11–12 (animal) and 13 (egg) (Chile: Valparaiso).

Bulimus (*Bulimus*) *potiezi* Mörch, 1857, Cat. Conchyl. Suenson, p. 8 (new name for *Bulimus rosaceus* Potiez and Michaud, 1838, supposedly distinct from King and Broderip's species).

Strophocheilus (*Megalobulimus*) *rosaceus* var. *particeps* Fulton, 1936, Proc. Mal. Soc. London, **22**, pt. 1, p. 10; Pl. 2, fig. 5 (Chile; refers to it also Reeve's Pl. 15, fig. 87*b*).

Morelet's *B. rosaceus* from Huanuco, Peru, I have referred tentatively to *S. capillaceus*, of which I have seen a specimen from the same locality.

The present location of the type of *S. rosaceus* is not known to me; but it may be at the British Museum. The figured type of Fulton's *particeps* is perhaps also there, as well as that of d'Orbigny's *rosaceus* var. *major*.

Specimens Examined. CHILE: several without more definite locality (A.M.N.H.; M.C.Z.; M.U.Mich.; U.S.N.M., including paratypes of *particeps;* M.N.H.(Chic.). Valparaiso (M.C.Z.; M.U.Mich.; U.S.N.M.; A.M.N.H.). Huasco (U.S.N.M.).

S. rosaceus is readily recognized, although varying considerably in size. Fulton's var. *particeps,* of which I have seen two paratypes (U.S.N.M. No. 466740), was based upon the larger specimens, which are of a lighter color (being deprived of the periostracum), usually without markings and with darker peristome (variable in intensity, sometimes bright orange-brown). They are, moreover, as a rule greatly worn, having thus lost much of the granulation of the body-whorl. The extremes in size are connected by gradations, as shown in my table of measurements. The other characters are not correlated with size. The peristome is usually white and this is the case even in one of the largest specimens I have seen (65 mm. long), as well as in one of the paratypes of *particeps;* occasionally it is orange, even in some small shells. The outer lip is thickened within, with a thin, moderately reflexed and somewhat upturned rim; it is little accrescent in old age (widest rim seen, 2 mm. wide, in a shell 48 mm. long). Fresh shells, covered with the periostracum, are light yellowish-brown, somewhat pinkish on the earlier whorls, the penultimate and body-whorl obscurely speckled with small, vertical, yellowish-white spots, sometimes arranged in zigzag vertical stripes; aperture fleshy-brown within; outer lip sometimes with a pinkish hue in the groove behind the upturned rim. Old shells lose the periostracum and are then pinkish-white, without speckling.

Measurements of Adult Shells

	Width in	Width in	Aperture			
Length	front view	profile	Length	Width	Whorls	
67 mm.	34.5	29	38.5	18	5½	Chile
65	35	31	38.5	17	5⅓	Valparaiso
64	35	31.5	35	17	5⅓	Chile
63.5	33.5	30.5	38	17	5⅓	“ ; paratype of *particeps*
61	32	30	34.5	16	5⅓	“
60	33	29.5	35	16	5⅓	Valparaiso
57	29.5	26	31.5	14	5⅓	“
55	31	28	33	15.5	5⅓	“
53.5	28	24.5	30	14	5⅓	Chile
51.5	28	24.5	32	12.5	5⅓	“
49	29	26	31	15	5	“
48	25	23	28.5	12	5	“
47	25.5	23.5	27	13	5	Valparaiso
44.5	25.5	24	27.5	12.5	5	Chile

The type of *B. rosaceus* was said to be 2⅛ inches [=54 mm.] long and 1 inch [=25.4 mm.] wide. Sowerby's (1833) figure, presumably of a cotype, is 53 mm. long, 29 mm. wide, the aperture 30 by 13 mm. Fulton gives as measurements for *particeps:* length, 63 mm.; width, 31 mm. d'Orbigny's var. *major* measured 58 mm. in length and 33 mm. in width. It will be noted that this bridges the gap between the 57 mm. and the 60 mm. specimens of my table.

b. S. ROSACEUS SENERI (Jousseaume)

Pl. 31, figs 1, 6

Borus seneri Jousseaume, 1884, Bull. Soc. Zool. France, **8**, Proc.-Verb. for 1883, p. xxx ("Nouvelle Grenade?"; with description); 1884, *Op. cit.*, **9**, p. 169; Pl. 4, fig. 3 (type; name spelled "*senezi*" on p. 171 and said to be given for one "Senez").

Bulimus seneri Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 217.

Strophocheilus (*Borus*) *capillaceus* var. *seneri* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 31; Pl. 30, fig. 23 (after Jousseaume); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

The type is at the Paris Museum (E. Fischer, *in litt.*, 1947). I owe the two photographs shown on Pl. 31 to Dr. Fischer's kindness.

In order to clear up the status of the puzzling *B. seneri*, I asked Dr. Fischer to compare the type with specimens of *S. oblongus hæmastomus*, *S. oblongus musculus*, *S. intertextus* and *S. capillaceus*, which seemed to be possibly related to judge from Jousseaume's figure. Dr. Fischer concluded, however, that it could not be referred to any of these. His photographs make this clear, for they show that *seneri* is an unusually large and wide form of *S. rosaceus*. The strongly crenulated suture, the heavy, irregular and more or less anastomosing riblets of the body-whorl, the broad and flattened columella, and the widely open and deeply perforate umbilicus are characteristic of that species. The general outline and the shape of the aperture and outer lip are also the same. It may be noted that Jousseaume's figure is a poor representation of the shell, the crenulation of the suture in particular being not sufficiently marked.

Presumably *seneri* is no more than an abnormally large *rosaceus*. I retain it provisionally with subspecific status, because it is relatively much broader for the length than any other *rosaceus* I have seen; while, according to a sketch sent by Dr. Fischer, the umbilicus appears to be more broadly open than usual. Possibly it may represent a subfossil or extinct race, as the shell appears to be old, much weathered and rather heavy.

Jousseaume gave the measurements (in mm.) as follows: length, 70; width, 37; aperture, 35 by 20.

The locality "New Grenada," given tentatively by the author, was a mere guess. He states that he had bought the specimen together with some other shells collected in Columbia. The true habitat of *seneri* is unknown.

Strophocheilus (Chiliborus) chilensis (Sowerby)

Pl. 11, figs. 1, 2, 3

Bulinus chilensis Sowerby, 1833 (March 15), Conchol. Illustr., *Bulinus*, fig. 4 of Pt. 22 (no description; no locality; with name in printed list, published with the part); 1833 (May 17), Proc. Zool. Soc. London, for 1833, p. 36 (description. Chile: Coquimbo).[1] T. Müller, 1836, Synopsis Nov. Test. Viv. Anno 1834 Promulgatorum, p. 24.

Bulimus chilensis Jay, 1836, Cat. Shells Coll., 2d Ed., p. 40; 1839, *Op. cit.*, 3d Ed., p. 55; 1850, *Op. cit.*, 4th Ed., p. 192. A. and J.-B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 20. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 152.

Bulimus (Bulimus) chilensis Beck, 1837, Index Moll., pt. 1, p. 52.

Bulimulus chilensis Dautzenberg, 1896, Actes Soc. Scientif. Chili, **6**, p. lxvii (Chile: Cordillera de los Andes).

Strophocheilus (Chiliborus) chilensis Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6.

Bulimus rosaceus var. Deshayes, 1838, in Lamarck, Hist. Nat. Anim. Sans Vert., 2 Ed., **8**, p. 269 (in part); 1844, *Op. cit.*, 3d Ed., **3**, p. 365; 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 36 (in part); Pl. 139, figs. 22–23 (Expl. of Plates, p. 20). Hupé, 1854, in Gay, Hist. Fis. Pol. Chile, Zool., **8**, p. 106 (in part). Not of King and Broderip, 1832.

Bulimus rosaceus var. *minor* d'Orbigny, 1837, Voy. Amér. Mérid., **5**, pt. 3, Moll., p. 304 (Chile: Coquimbo).

Bulimus squammulatus "de Cristofori and Jan" A. and J.-B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 20 (as a synonym of *Bulimus chilensis*).

Bulimus crenulatus Pfeiffer, 1845, (December), Zeitschr. f. Malak., **2**, p. 156 (Chile; new name for *Bulinus chilensis* Sowerby; also with description); 1848, Monogr. Helic. Viv., **2**, p. 53. Mörch, 1850, Cat. Conchyl. Kierulf, p. 7. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 317. H. and A. Adams, 1855, Gen. Rec. Moll., 2, p. 146. Pfeiffer, 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 251; Pl. 68, figs. 8–9; 1859, Monogr. Helic. Viv., **3**, p. 380. A. D. Brown, 1866, Cat. Shells Coll., 2d Ed., p. 52. Haines,

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[1] As pointed out by Pilsbry (1926), *Bulinus chilensis* Sowerby is not a homonym of *Bulimus chilensis* Lesson, 1831, which is not now placed in *Strophocheilus*. Reeve cites Broderip by error as the author of *Bulinus chilensis* Sowerby.

1868, Cat. Terr. Shells Coll., p. 46. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 24. Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 43 (Chile: Talcahuano; Coquimbo; Huasco); 1872, Moluscos del Viaje al Pacífico, **1**, p. 54. Paetel, 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 38; 1877, *Op cit.*, **8**, p. 605. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 210. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 89 and 200.

Bulimus (*Scutalus*) *crenulatus* Albers, 1850, Die Heliceen, p. 160. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 152.

Bulimus (*Bulimus*) *crenulatus* Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27; 1857, Cat. Conchyl. Suenson, p. 8.

Orthalicus (*Scutalus*) *crenulatus* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 158.

Bulimus (*Borus*) *crenulatus* v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 22. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224.

Borus crenulatus Mörch, 1863, Cat. Conchyl. Lassen, p. 4.

Strophocheilus (*Borus*) *crenulatus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 33; Pl. 13, figs. 65–67 (specimens); 1901, *Op. cit.*, (2), **14**, p. 126; 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Bulimus (*Borus*) *credulatus* G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 121 (error for *crenulatus*).

The figured type of Sowerby's *B. chilensis*, from the Cuming Collection, is possibly at the British Museum. Pfeiffer's *B. crenulatus* was originally introduced as a new name for *chilensis*, however, with a description based on specimens also from the Cuming Collection. The type of d'Orbigny's *B. rosaceus* var. *minor* should be at the British Museum.

Specimens Examined. CHILE: several without more definite locality (A.M.N.H.; M.C.Z.; M.U.Mich.; U.S.N.M.). Coquimbo, topotypes and probably even cotypes (M.C.Z.; M.U.Mich.; U.S.N.M.)[1] Cruz Grande near Coquimbo (T. Hallinan. — M.C.Z.).

Most of the specimens of *chilensis* in collections were evidently found alive. They are covered with the periostracum, which is thin, fairly uniformly pale dirty-yellowish, with a few narrow, darker vertical streaks on the body-whorl. The outer lip is white, strongly expanded, moderately thickened in old age, with a recurved rim. It should be noted that Sowerby's original figure is very poor, particularly for the aperture; it shows a bulge on the columella, which I have never seen in any specimen of *chilensis*. The narrowed, raised spire is also exaggerated at the tip. Pilsbry's figures, on the other hand, are excellent. The figures in the Syst. Conch. Cab. are mediocre; those by Deshayes (in Férussac) are among the best.

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[1] Pfeiffer (1845) states that he saw several hundred specimens from the Cuming Collection.

Sowerby's figure measures (in mm.): length, 38; greatest width, 22; aperture, 21.5 by 10. The measurements given with the first description were: length, 1.4 inch [=35.5 mm.]; width, 0.75 inch [=19 mm.]. Pfeiffer gave for his *crenulatus:* "Long. 38, diam. 19 mm." d'Orbigny's *rosaceus* var. *minor* was 34 mm. long and 18 mm. wide.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
41 mm.	22	19	23.5	12	4	Coquimbo
39	22	20	24	10	4	Chile
37	22	18	23	11.5	4	Coquimbo
35	20	17	21.5	9.5	4	Chile
33.5	20	16	21	10.5	4	Coquimbo
31	18	15.5	19	9.5	3¾	"
29	19	15.5	18.5	8.5	3¾	Chile
27	15	14	15	7	3¾	"
26.5	16.5	14.5	16.5	8	3¾	"

STROPHOCHEILUS (CHILIBORUS) PACHYCHILUS (Pfeiffer)

Pl. 8, figs. 2, 4

Bulimus pachychilus Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 48 (Chile: Huasco); 1843 (February), Proc. Zool. Soc. London, for 1842, p. 186 (Chile: La Questa de Arenas near Huasco); 1843 (October), in Philippi, Abb. Beschr. Conch., **1**, pt. 3, p. 57; Pl. 1 (*Bulimus*), fig. 14 (2 views of type). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 158. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 46. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 204. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 324; 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 251; Pl. 68, figs. 6–7 (2 views of cotype); 1859, Monogr. Helic. Viv., **4**, p. 383, 1868, *Op. cit.*, **6**, p. 29. Haines, 1868, Cat. Terr. Shells Coll., p. 53. Paetel, 1869, Moll. Syst. Cat., p. 79. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 44; 1877, *Op. cit.*, **8**, p. 605. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 215.

Bulimus (*Borus*) *pachychilus* Albers, 1850, Die Heliceen, p. 142. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 192; 1876, Novit. Conchol., Abt. I, **5**, pts. 50–51, p. 22. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 224. G. Nevill, 1879, Hand List Moll. Indian Mus., **1**, (1878), p. 121. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 119.

Bulimus (*Scutalus*) *pachychilus* Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 152.

Bulimus (*Bulimus*) *pachychilus* Mörch, 1857, Cat. Conchyl. Suenson, p. 8.

Strophocheilus (*Borus*) *pachychilus* Pilsbry, 1895, Man. of Conch., (2), **10**, p. 35; Pl. 12, figs. 63–64 (specimen); 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus (*Chiliborus*) *pachychilus* Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6.

Bulimus pachycheilus Reeve, 1848, Conch. Icon., **5**, *Bulimus*, in letterpress to Pl. 15, fig. 87 (as a variety of *B. rosaceus* from Huasco). H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 146. A. D. Brown, 1866, Cat. Shells Coll., 2d Ed., p. 59. Paetel, 1873, Cat. Conch.-Samml., p. 98.

Pfeiffer described *B. pachychilus* from specimens collected by Bridges, but communicated by Cuming. It is probable therefore that the type figured in 1843 was returned to Cuming and may now be at the British Museum.

Specimens Examined. CHILE: La Questa de Arenas near Huasco, several paratypes, collected by Bridges (U.S.N.M.; M.C.Z.). Also many specimens without definite locality, which I suspect were all originally part of the type lot collected by Bridges near Huasco (M.C.Z.; A.M.N.H.; M.U.Mich.; U.S.M.N.). The species never seems to have been collected again.

I have long been in doubt as to the correct status of *pachychilus*, being at first inclined to regard it as only a subspecies of *S. chilensis*. However, in all specimens seen the sculpture, although of the same type as found in *chilensis*, is very decidedly finer, the granules being minute on the body-whorl; the difference is particularly striking on the subsutural area. In addition, the subsutural crenulation is less pronounced and more irregular; the shell becomes thicker and is chalky-white even in very fresh, relatively young and as yet thin shells; the periostracum when preserved is nearly white, with a few pale dirty-yellowish vertical streaks; the peristome is white and considerably thickened all around in old age, even the parietal wall being sometimes raised above the surface of the body-whorl (much as in old specimens of *S. lichtensteini*, as described before), while the accrescent outer lip is up to 5 mm. wide behind the rim; and the outer lip is less arched than in *chilensis*. I have seen no transitional specimens between the two.

Pfeiffer (1842) gave the original measurements as: length 39, diameter 22 mm. The figure of the type (1843) is 36 mm. long, 21 mm. in greatest width, aperture 20 by 11 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
38 mm.	21.5	19.5	22.5	10	4	Chile
37	21.5	21	23	10	4	Huasco
36	19	18	21	11	4	"
35.5	19	17.5	19	10.5	4	Chile
34	19	17.5	20	10	4	Huasco
33	19	18	19.5	10	3¾	Chile

STROPHOCHEILUS (CHILIBORUS) BRIDGESII (Pfeiffer)

Pl. 13, figs. 2, 3; Pl. 14, fig. 3

Bulimus bridgesii Pfeiffer, 1842, Symb. Hist. Helic., **2**, p. 43 (Chile: Huasco); 1843 (February), Proc. Zool. Soc. London, for 1842, p. 186 (Chile: town of Frierina near Huasco); 1843 (October), in Philippi, Abb. Beschr. Conch., **1**, pt. 3, p. 58; Pl. 1 (*Bulimus*), fig. 15 (2 views of type). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 151. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 19, fig. 117 (cotype). Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 47. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 191. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 334. Hupé, 1854, in Gay, Hist. Fis. Pol. Chile, Zool., **8**, p. 107; Atlas, Pl. 3, fig. 4. Pfeiffer, 1855, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 252; Pl. 68, figs. 10–11 (2 views of cotype); 1859, Monogr. Helic. Viv., **4**, p. 396. A. D. Brown, 1861, Cat. Shells Coll., p. 43; 1866, *Op. cit.*, 2d Ed., p. 51. Haines, 1868, Cat. Terr. Shells Coll., p. 44. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 42; 1876, *Op. cit.*, **8**, p. 54.

Bulimus (Scutalus) bridgesi Albers, 1850, Die Heliceen, p. 160. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 152.

Orthalicus (Scutalus) bridgesi H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 158.

Bulimus (Bulimus) bridgesii Mörch, 1857, Cat. Conchyl. Suenson, p. 7.

Bulimus (Scutalus) bridgesi v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 217.

Bulimus (Borus) bridgesi Pfeiffer, 1879, Nomencl. Helic. Viv., p. 225.

Bulimulus bridgesi Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 222.

Strophocheilus (Borus) bridgesi Pilsbry, 1895, Man. of Conch., (2), **10**, p. 35; Pl. 2, figs. 4–6 (specimen); 1896, *Op. cit.*, (2), **10**, p. 197; 1902, *Op. cit.*, (2), **14**, Classification, p. v.

Strophocheilus (Chiliborus) bridgesi Pilsbry, 1926, Proc. Ac. Nat. Sci. Philadelphia, **78**, p. 6.

Like *S. pachychilus*, *S. bridgesii* was described by Pfeiffer from specimens collected by Bridges and communicated by Cuming. The type figured in 1843 may have been returned to Cuming and is possibly now at the British Museum.

Specimens Examined. CHILE: Huasco, several paratypes collected by Bridges (U.S.N.M.; M.U.Mich.; M.C.Z.; A.M.N.H.). Also specimens without more definite locality, probably all originally from the type lot (U.S.N.M.; A.M.N.H.; M.C.Z.; M.U.Mich.), as I cannot find that the species was ever collected again.

S. bridgesii is the smallest and most slender species of the genus. All specimens seen were evidently collected fresh or alive, being covered with a thin, very pale yellowish periostracum, with an occasional slightly darker yellowish vertical streak. The sculpture is very delicate and often worn off, so that in some specimens the nepionic shell appears to be smooth. In perfect shells, however, very fine raised lines may be traced from close to the beginning of the first whorl to the very rim of the outer lip. On later whorls the lines are cut up into minute granules, which become somewhat coarser on the body-whorl, particularly below the suture and toward the outer lip. Peristome white; outer lip strongly expanded, in front view with a broad, nearly flat, thin rim; columella thin and flat, covering, but not closing the umbilical slit, which is openly rimate or even perforate. The first nepionic whorls are more swollen than usual, somewhat bulbous, being much more convex than the next.

Pfeiffer's (1842) original measurements were (in mm.): length 23, diameter 11 mm. The figure of the type (1843) is 23.5 mm. long, 12 mm. in greatest width, aperture 13 by 6 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
23 mm.	11.5	10	13	5.5	4⅓	Huasco
22	10.5	10	12.5	5.5	4⅓	"
21	10	9.5	12	6	4⅓	"
20.5	10	9	12	5.5	4¼	"
19.5	10	9	11.5	5.5	4¼	"
19	9	8.5	11.5	5.5	4¼	"

Genus GONYOSTOMUS Beck

Characters. Shell medium-sized (30 to 62 mm. long), either elongate-fusiform or ovate-conic, always longer than greatest width, very little or not flattened dorso-ventrally; body-whorl relatively large;

apex obtusely pointed. Periostracum thin, but often well preserved. Either unicolorous or marked with vertical flames or blotches of white or pale yellow and brown; the markings are in the shell material itself and persist after the periostracum wears off. Aperture higher than wide, either broadly ovate with evenly rounded base, or strongly narrowed and angular below. Columella thin, with a very weak fold deep within the aperture. Umbilicus openly rimate, sometimes almost funnel-shaped. Outer lip evenly arcuate; rim expanded or reflexed and slightly thickened, never accrescent. Nepionic shell moderately large; earliest whorls with crowded or spaced spiral rows of minute granulation; later ones with vertical, raised growth-lines decussated by spiral engraved lines into granules or small welts. Post-nepionic whorls mostly covered with fine or coarse granulation in irregular spiral rows.

The animal is known only for *G. multicolor,* where it is essentially like that of *Strophocheilus* (Pilsbry, 1902). The soft anatomy, jaw, and radula are also as in that genus, according to Pilsbry's (1902) observations on *G. multicolor* and *G. turnix.* Unfortunately, not much is known as yet of the animal or anatomy of the subgenus *Gonyostomus,* proper, except for W. G. Binney's (1874) brief description of the radula of *G. egregius.*

The few species of *Gonyostomus* are restricted to a small area of southeastern Brazil, being known only from the states of Rio de Janeiro, São Paulo, and Espírito Santo.

Originally proposed as a subgenus of *Bulimus,* without characterisation, *Gonyostomus* was first clearly defined by Pilsbry (1896, Man. of Conch., (2), **10**, p. 121). He regarded it at first as a subgenus of *Auris,* in the family Bulimulidae. The study of the anatomy later led him to transfer it to the Strophocheilidae (1902, *Op. cit.,* (2), **14**, Classification, p. vi), when he also raised it to generic rank.

Nothing much appears to be known of the conditions under which *Gonyostomus* lives. It is surmised that the species are all terrestrial, as Rang (1831) stated that he found *G. multicolor* under a rock. v. Martens (1860) suspected that some species might be arboreal, for which, however, there is no evidence.

Synopsis of Subgenera and Species

Although differing conspicuously in shape, particularly of the aperture, *Anthinus* has exactly the type of sculpture of *Gonyostomus,* proper, especially on the nepionic whorls. These two groups are evidently very closely related and at most subgenerically distinct.

A. Subgenus *Gonyostomus*, proper. Shell slender, elongate-fusiform. Aperture usually less than half the total length, constricted and roundly angular below, the base of the body-whorl forming a channel marked outwardly by a blunt ridge.

1. Unicolorous, chestnut-brown. Uniformly covered with crowded, spiral rows of small granules. Length, 49 to 62 mm. *G. goniostoma.*

2. Purplish-brown, with whitish-yellow oblique flames and blotches. Spiral rows of granules coarser and more irregular than in *goniostoma*, often obsolete in certain areas. Length, 41 to 51 mm. *G. egregius.*

B. Subgenus *Anthinus.* Shell elongate-conic to ovate-conic. Aperture over half the total length, broadly and evenly curved below, the base of the body-whorl not channelled nor carinate.

3. Relatively slender, more elongate-conic, with moderately convex body-whorl. Aperture rather narrow, not conspicuously widened nor expanded at base. Surface appearing smooth, more or less covered with minute granules, arranged spirally. Purplish-brown, with many and extensive white blotches and variously dissected slanting white streaks; white areas thickened, somewhat porcelain-like. Length, 33 to 35 mm. *G. multicolor* (with subsp. *miersii*).

4. Relatively broad, ovate-conic, with swollen body-whorl. Aperture broad, widened and much expanded in basal half. Surface appearing wrinkled, with crowded, vertical, thin folds, decussated into granulation by many fine, spiral impressed lines. Blotched and marbled with white and brown, forming an irregular checkered pattern; white areas not thickened nor porcelain-like. Length, 48 to 55 mm. *G. turnix.*

Doubtful and Excluded Species. Bulimus versicolor de Cristofori and Jan, 1832, Dispos. Method. Gen. Moll. Terr. Fluv. (Catal., Sect. II, Pars 1, Fasc. 1), p. 4 (Brazil); Mantissa, p. 3 (description). This may have been a *Gonyostomus*, as suggested by Pilsbry (1901, Man. of Conch., (2), **14**, p. 172); but it has not been recognized. The description is as follows: "B. testa oblonga, ovata, subperforata, longitudinaliter striata, viridi-rufescente maculis albidis variegata (alt. 1″ 6‴ [=40.5 mm.], lat. 10‴ [=22.5 mm.]), apertura ovali (1″ diam. long. [=27 mm.], 6‴ diam. trans. [=13.5 mm.]), peristomate reflexo albo." This description might fit *G. turnix*, but it would be presumptuous to adopt the name unless the type could be found.

Goniostomus subhybridus Da Costa, 1906, Proc. Mal. Soc. London, **7**, pt. 2, p. 97; Pl. 11, fig. 7 (Pozuzo, eastern Peru), is *Drymaeus pulcherrimus* (H. Adams, 1866), according to Fulton (1920, Proc. Mal. Soc. London, **14**, pt. 1, p. 3).

Bulimus (*Gonyostomus*) *concolor* Beck, 1837, Index Moll., Pt. 1, p. 53 ("Rep. Argentina") is a *nomen nudum.*

Subgenus Gonyostomus, proper

Bulimus subg. *Gonyostomus* Beck, 1837, Index Moll., pt. 1, p. 53 (without description; for two described and two undescribed species). Type by tautonomy and by designation of Gray, 1847, Proc. Zool. Soc. London, p. 147: "*Helix gonyostoma*" [=*Helix* (*Cochlogena*) *goniostoma* Férussac, 1821], one of the two described species originally included.

Bulimus subg. *Gonyostoma* Swainson, 1840, Treatise on Malacology, pp. 177 and 181 (with description. "Represented by the *Bulimus* of that name, fig. 25" [=*Helix* (*Cochlogena*) *goniostoma* Férussac, 1821], which is the type.

Bulimus subg. *Goniostoma* Swainson, 1840, Treatise on Malacology, pp. 179 and 335 (with description, on p. 335). Monotypic for "*T. erubescens* Sw., Zool. Journ., **1**, pl. 5, fig. 2" [=*Helix* (*Cochlogena*) *goniostoma* Férussac, 1821]. Not *Goniostoma* Villa, 1841; nor of A. Adams, 1860.

Goniostomus Herrmannsen, 1847, Ind. Gen. Malacoz., **1**, pt. 4, p. 487 (emendation of *Gonyostomus* Beck; same type, by present designation).

Gonyotomus Paetel, 1875, Fam. Gatt. Moll., p. 88 (error for *Gonyostomus* Beck; same type by present designation).

Cochlorina Jan, 1830, Conspectus Meth. Test., p. 5, was proposed for two described species, *auris-leporis* Bruguière and *goniostoma* Férussac.[1] In order to avoid its possible use for *Gonyostomus,* I herewith designate as type of *Cochlorina* the first species, *Bulimus auris-leporis* Bruguière, 1792. This species was included by Pilsbry in his subgenus *Zaplagius* Pilsbry, 1896, which he later raised to generic rank. The type of *Zaplagius* is *Helix navicula* Wagner, 1827. Although *Cochlorina* antedates *Zaplagius,* the latter name will probably be retained at least for a subgenus, as *navicula* differs markedly from *auris-leporis.*

Of the two undescribed species (*nomina nuda*) included by Beck in his *Gonyostomus, Bulimus* (*G.*) *centiquadrus,* from Paraguay, was recognized by Ancey as a synonym of *G. turnix* (Gould). The other. *B.* (*G.*) *concolor,* from Argentina, was not traced.

Gonyostomus (Gonyostomus) goniostoma (Férussac)

Pl. 13, fig. 1; Pl. 16, fig. 2; Pl. 20, fig. 4; Pl 23, fig. 2; Pl. 28, fig. 5

[J. Mawe, 1812, Travels in the Interior of Brazil, Plate of Mollusks, fig. 3 (Brazil; figure not colored)].

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[1] I am indebted to Mr. Harald E. Rehder for a copy of the passage in which *Cochlorina* is proposed, as I was unable to consult Jan's book.

Helix (*Cochlogena*) *goniostoma* Férussac, 1821, Tabl. Syst. Moll., Tabl. Limaçons, p. 57 (no description; no locality; defined by the one positive reference to Mawe, 1812, Plate of Mollusks, fig. 3; the second doubtful reference to Lister, 1692, Pl. 1059, fig. 4, is to a species of *Euglandina*). Rang, 1831, Ann. Sci. Nat., **24**, p. 59 (eastern Brazil).

Bulimus goniostoma Sowerby, 1825 (March), Zool. Journ., **1**, No. 1, p. 59; Pl. 5, fig. 2 (first description; colored figure. Brazil). Jay, 1835, Cat. Shells Coll., p. 31; 1836, *Op. cit.*, 2d Ed., p. 40; 1839, *Op. cit.*, 3d Ed., p. 55; 1850, *Op. cit.*, 4th Ed., p. 197. Deshayes, 1838, in Lamarck, Hist. Nat. An. Sans Vert., 2d Ed., **8**, p. 249; 1844, *Op. cit.*, 3d Ed., **3**, p. 358. Porro, 1846, Coll. Mus. Modiol., Moll. Terr. Fluv., p. 13. Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 154. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 34, fig. 206. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 105; Atlas, Pl. 143, figs. 9–10 (Expl. of Plates, p. 20). Kriechbaumer, 1866, Malak. Blätt., **13**, p. 14 (type of *Limnaeus papyraceus* Spix).

Cochlogena goniostoma Sowerby, 1825, Cat. Coll. Earl Tankerville, p. 39.

Pupa goniostoma J. E. Gray, 1825, Ann. of Phil., (N.S.), **9**, p. 412.

Helix goniostoma Wood, 1828, Index Testaceologicus, 2d Ed., Appendix, p. 22; Pl. 7, fig. 24; 1856, *Op. cit.*, Hanley Ed., p. 227; Pl. 7 (Appendix), fig. 24.

Cochlorina goniostoma Jan, 1830, Conspectus Meth. Test., p. 5.

Bulimus (*Gonyostomus*) *goniostoma* Beck, 1837, Index Moll., pt. 1, p. 53 (Brazil: Rio de Janeiro).

Bulimus (*Bulimus*) *goniostoma* Anton, 1839, Verzeichniss Conchyl. Samml., p. 41.

Auricula goniostoma A. and J. B. Villa, 1841, Dispos. Syst. Conch. Terr. Fluv., p. 6.

Otostomus (*Goniostomus*) *goniostoma* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 151.

Auris (*Gonyostomus*) *goniostoma* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 122; Pl. 43, fig. 76 (after Reeve).

Gonyostomus goniostoma Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. viii.

Bulimus goniostomus Menke, 1828, Synops. Meth. Moll., p. 15. Potiez and Michaud, 1838, Gal. Moll. Douai, **1**, p. 141; Atlas, Pl. 14, figs. 17–18. Küster, 1841, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 21; Pl. 5, figs. 1–2. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 50; 1853, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. ix; 1853, Monogr. Helic. Viv., **3**, p. 372. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 56. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 440. A. D. Brown, 1866, Cat. Shells Coll., 2d Ed., p. 55. Haines, 1868, Cat. Terr. Shells Coll., p. 48. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 77. Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 49 (Brasil: Macahé near Cabo Frio, Est. Rio de Janeiro); 1872, Moluscos del Viaje al Pacífico, **1**, p. 76. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 108. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 211. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), p. 96.

Bulimus (Gonyostomus) goniostomus Albers, 1850, Die Heliceen, p. 150. Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27. Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 118.

Bulimus (Goniostomus) goniostomus Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 150. Mörch, 1857, Cat. Conchyl. Suenson, p. 7.

Otostomus (Goniostomus) goniostomus Chenu, 1859, Man. Conchyl., **1**, p. 437, fig. 3215.

Bulimus (Plekocheilus, subsect. *Gonyostomus) goniostomus* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 221.

Bulimus (Pelecychilus) gonostomus v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 188 (misprint for *goniostomus*).

Bulimus gonostomus Paetel, 1873, Cat. Conch.-Samml., p. 98.

Limnaeus [*Lymnaeus* on Plate] *papyraceus* Spix, 1827, Test. Fluv. Brasiliam, p. 17; Pl. 10, fig. 5 (Brazil: Prov. Sebastianopolis [=São Sebastião], Est. Rio de Janeiro).

Bulimus (Goniostoma) erubescens Swainson, 1840, Treatise on Malacology, p. 335 (defined by the reference to Sowerby, Zool. Journ., **1**, Pl. 5, fig. 2). Not of Pfeiffer, 1847.

Férussac having originally defined his *H. goniostoma* merely by the reference to Mawe's figure, the latter's shell may be regarded as the type. It is not known whether this specimen is yet in existence. The present location of the shell on which Sowerby (1825) based the first description, is likewise unknown. The type of *Limnæus papyraceus* was at the Munich Museum, when examined by Kriechbaumer in 1866.

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; U.S.N.M.; Ac.N.S.Phila.; M.U.Mich.; M.N.H.Chic.; A.M.N.H.).

This species appears to be restricted to the state of Rio de Janeiro, but there are at present only two definite locality records (Macahé near Cabo Frio and São Sebastião).

The peristome of fresh shells is either white or more or less tinged with pink, but never very brightly. The pinkish color extends some distance inside the aperture; when the outer lip is white, it is usually preceded by a pinkish zone, visible both inside and outside, behind the reflexed rim. The earliest nepionic whorls are sometimes lost in life, the tip being then closed up by a new deposit of lime. The granulation covers the body-whorl uniformly, being always well-marked, even behind the rim of the outer lip.

Mawe's figure measures (in mm.): length, 56; greatest width, 19; aperture, 25 by 7. The shell figured by Sowerby was 60 mm. long, 20.5 mm. wide, the aperture 29 by 8 mm. Deshayes' (1851) figure is 55 mm. long, 19.5 mm. wide, the aperture 27 by 8 mm.

Measurements of Complete Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
62 mm.	20	18	28.5	8.5	5½	Brazil
59	19	17.5	28	8	5½	"
57	17	15	26.5	7.5	5½	"
54	19	17	27	8	5½	"
54	16.5	15	25	7	5½	"
50.5	15.5	14.5	23	7	5	"
49	16	15	23	6.5	5	"

Original description of *Limnaeus papyraceus*: "L. testa ovato-oblonga, tenui, pellucida, nitida, longitudinaliter subtilissime striata, lutescente; spira obtusa, rubescente; apertura longitudinali, margine sinistro subreflexo et roseo. Testa elongata, oblonga, tenuis, pellucida, nitida, striis longitudinalibus tenuissimis. Anfractus sex convexiusculi; ultimus spira major, oblongus; lineis transversis nonnullis, ex granulis minutissimis conpositis. Spira conica, apice obtuso et planulato; striis anfractuum transversis simplicibus, subtilissimis, vix nudis oculis conspicuis. Apertura longitudinalis, angustata; margo dexter simplex, tenuis; margo sinister subreflexus ad columellam plicam obliquam formans, umbilicum longitudinalem partim obtegens. Color testae flavescens; spirae anfractus quatuor supremi pallide rubescentes. Plica columellaris rosea. Longitudo 1 poll. 3 lin. [=31.7 mm.]; lat. 5½ lin. [=11.6 mm.]." Kriechbaumer (1866) recognized that the type was an immature *G. goniostoma*. A comparison of the description and figure with a young specimen at M.C.Z. fully bears this out. The characteristic sculpture is particularly well described. Ancey later (1906, Jl. de Conchyl., **53**, p. 322) claimed that *L. papyraceus* Spix was *Synapterpes hanleyi* (Pfeiffer); but he was evidently unaware of Kreichbaumer's identification. Moreover, he does not seem to have consulted Spix' original account, which does not agree with *S. hanleyi*, particularly in sculpture. Ancey refers only to Küster's description and figures (1862, Syst. Conch. Cab., **1**, Abt. 17*b*, p. 33; Pl. 6, figs. 9–10) which do not fit Spix' species, but *S. hanleyi*. Kriechbaumer (1866) had called attention to Küster's error, as well as to the fact that Deshayes' French description of 1838 (in Lamarck, Hist. Nat. Anim. Sans Vert., 2d Ed., **8**, p. 416), of a supposed *Lymnaea papyracea*, was likewise based on a different species.

GONYOSTOMUS (GONYOSTOMUS) EGREGIUS (Pfeiffer)

Pl. 3, fig. 2; Pl. 11, fig. 4; Pl. 14, fig. 2; Pl. 28, fig. 4

[J. Mawe, 1812, Travels in the Interior of Brazil, Plate of Mollusks, fig. 4 (Brazil)].

Bulimus egregius Pfeiffer, 1845 (July), Proc. Zool. Soc. London, for 1845, p. 67 (no locality); 1848, Monogr. Helic. Viv., **2**, p. 50. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 34, fig. 205 (type, from Cuming Coll. Brazil: Rio de Janeiro). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 195. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 104; Atlas, Pl. 143, figs. 7–8 (Expl. of Plates, p. 20). Gould, 1852, U. S. Explor. Exped., Moll. Shells, p. 77; Atlas, Pl. 6, figs. 86–86*a* (type of *hybridus* Gould); 1862, Otia Conchol., p. 244. Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 372. A. D. Brown, 1866, Cat. Shells Coll., 2d Ed., p. 53.

Bulimus (Gonyostomus) egregius Albers, 1850, Die Heliceen, p. 150.

Otostomus (Gonyostomus) egregius H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 151.

Bulimus (Goniostomus) egregius Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 150.

Bulimus (Pachyotus) egregius W. G. Binney, 1874, Proc. Ac. Nat. Sci. Philadelphia, pp. 54, 58, and 62; Pl. 6, fig. 1 (radula); 1884, Ann. New York Ac. Sci., **3**, (1883), pts. 3–4, p. 114; Pl. 11, fig. B (radula).

Bulimus hybridus Gould, 1846 (December), Proc. Boston Soc. Nat. Hist., **2**, p. 191 (Brazil: Rio de Janeiro). Jay, 1850, Cat. Shells Coll., 4th Ed., p. 198. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 56. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 440. Gould, 1862, Otia Conchol., p. 32. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 77. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 49 (Brazil: Macahé, Est. Rio de Janeiro); 1872, Moluscos del Viaje al Pacífico, **1**, p. 76. Paetel, 1873, Cat. Conchyl.- Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 108. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 212. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), pp. 96 and 189.

Bulimus (Pelecychilus) hybridus v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 188.

Goniostomus hybridus Mörch, 1863, Cat. Conchyl. Lassen, p. 4.

Bulimus (Plekocheilus, subsect. *Gonyostomus) hybridus* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 221.

Auris (Gonyostomus) hybrida Pilsbry, 1896, Man. of Conch., (2), **10**, p. 123; Pl. 43, fig. 75 (after Reeve) (Brazil: Organ Mts., Est. Rio de Janeiro).

Gonyostomus hybrida Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. viii.

The older name *egregius* should be retained for this species. It does not duplicate *Pupa egregia* Jay, 1836, which was not originally described as a *Bulimus* and is not now placed in *Gonyostomus*.

Mawe's figure which I refer to *egregius* differs markedly from any specimen I have seen in the shorter and broader aperture. There is, however, no other known snail in Brazil which it could represent. The figure was probably based on an abnormal shell, unless it be due to the artist's fancy.

The type of *B. egregius*, described from the Cuming Collection, is probably at the British Museum. That of Gould's *B. hybridus*, collected by the U. S. Exploring Expedition, is at the U.S.N.M. (No. 5488), where I have seen it.

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; U.S.N.M.). Serra do Rio Preto near Campos, Est. Rio de Janeiro (D. Bourget. — M.C.Z.). Rio de Janeiro, holotype of *B. hybridus* (U.S.N.M.), and another specimen (A.M.N.H.). Organ Mountains, Est. Rio de Janeiro (J.S. Phillips. — Ac.N.S. Phila.; A.M.N.H.). Espírito Santo (M.U.Mich. — Locality probably erroneous).

This species is known with certainty only from the state of Rio de Janeiro, all reliable localities being located there. As the original label of the specimen supposedly from "Espírito Santo" is lacking, this occurrence is open to question.

Pilsbry recognized that *G. egregius* is a distinct species, not a race of *G. goniostoma*. In addition to the average smaller size and the color difference, the sculpture is much coarser and more irregular, the granules tending to become elongate, transverse welts, at least in some of the spiral rows, particularly on the body-whorl. In some specimens the granulation covers the entire shell; but in others it disappears over certain areas of the body-whorl. In most specimens seen the peristome is purplish-pink, more brightly so than in *goniostoma*. The few shells with nearly white outer lip may be faded. Although the figure of the type of *hybridus* (1852) shows a bright pink outer lip, it is now much faded in the specimen. Some specimens have many extensive, more or less confluent, dark brown markings. In others the darker blotches are few, small, in disconnected spots. Gould's type of *hybridus* is of the latter type.

Pfeiffer gave the original measurements of *B. egregius* as: "Long. 41, diam. 15 mm.;" but Reeve's figure, presumably of the type, measures (in mm.): length, 48; greatest width, 17; aperture, 22.5 by 7. Gould's measurements of *B. hybridus* were: length of axis 1¾ inch [=44.5 mm.] diameter ⅝ inch [=15.5 mm.]; his figure is 45 mm. long, 17 mm. in greatest width, the aperture 21.5 by 7 mm.; but the type is actually smaller, as shown below, although the shell is complete.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
51 mm.	15	15	23.5	7	5⅓	Campos
49	15.5	14	24	7	5⅓	"
49	16	14	22.5	7	5⅓	Espírito Santo
46.5	14	13.5	20.5	6.5	5	Campos
45	14	13.5	21	6.5	5	Brazil
42	15.5	13.5	20	6.5	5	Rio de Janeiro, holotype of *B. hybridus*

Subgenus Anthinus Albers

Bulimus subg. *Anthinus* Albers, 1850, Die Heliceen, p. 148 (with description; for four described species). Type by designation of v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 189: "*Bulimus multicolor* (Rang)" [=*Helix multicolor* Rang, 1831], one of the species originally included.

Gonyostomus (Anthinus) multicolor (Rang)

a. Typical multicolor

Pl. 4, fig. 5; Pl. 9, figs. 3, 7; Pl. 13, fig. 6; Pl. 17, fig. 4

Helix (*Cochlogena*) *multicolor* Rang, 1831 (September), Ann. Sci. Nat., **24**, p. 55; Pl. 3, fig. 1 (Brazil: Est. São Paulo and near Corcovado, Est. Rio de Janeiro).

Bulinus multicolor King and Broderip, 1832 (July), Zool. Journ., **5**, No. 19, (1831), p. 341 (Brazil; stated in a footnote to be *Helix multicolor* Rang). Sowerby, 1838 (before October 31), Conchol. Illustr., *Bulinus*, figs. 89 (2 figs.) of Pt. 144.

Bulimus multicolor Jay, 1835, Cat. Shells Coll., p. 31; 1836, *Op. cit.*, 2d Ed., p. 41; 1839, *Op. cit.*, 3d Ed., p. 56; 1850, *Op. cit.*, 4th Ed., p. 202. Deshayes, 1838, in Lamarck, Hist. Nat. An. Sans Vert., 2d Ed., **8**, p. 239; 1844, *Op. cit.*, 3d Ed., **3**, p. 354. Küster, 1841, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. 22; Pl. 5, figs. 3–4. Reeve, 1842, Conch. Syst., **2**, p. 81; Pl. 174, figs. 89 (2 figs.; copies of Sowerby's figures of 1838). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 157. Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 39, fig. 238. Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 42. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 40; Pl. 145, figs. 1–2 (Expl. of Plates, p. 20). Pfeiffer, 1852, Syst. Conch. Cab., **1**, Abt. 13, pt. 1, p. ix; 1853, Monogr. Helic. Viv., **3**, p. 332. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 56. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 396. A. D. Brown, 1861, Cat. Shells Coll., p. 47; 1866, *Op. cit.*, 2d Ed., p. 58. Haines, 1868, Cat. Terr. Shells Coll., p. 52. Pfeiffer, 1868, Monogr. Helic. Viv., **6**, p. 42. Paetel, 1869, Moll. Syst. Cat., p. 79. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 47 (Brazil: Macahé, Est. Rio de Janeiro). W. G. Binney and Bland, 1871, Amer. Jl. Conch., **6**, p. 208 (jaw, radula). Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 54. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 214. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), p. 94.

Bulimus (*Gonyostomus*) *multicolor* Beck, 1837, Index Moll., pt. 1, p. 53.

Bulimus (*Anthinus*) *multicolor* Albers, 1850, Die Heliceen, p. 148. Mörch, 1852, Cat. Conchyl. Yoldi, pt. 1, p. 27. H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 150. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 149. Mörch, 1857, Cat. Conchyl. Suenson, p. 7. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 189. W. G. Binney, 1874, Proc. Ac. Nat. Sci. Philadelphia, pp. 58 and 62; Pl. 6, fig. 8 (radula). Pfeiffer, 1879, Nomencl. Helic. Viv., p. 221. W. G. Binney, 1884, Ann. New York Ac. Sci., **3**, (1883), pts. 3–4, p. 114, Pl. 11, fig. A (radula). Römer, 1891, Jahrb. Nassau. Ver. Naturk., **44**, p. 118.

Auris (*Gonyostomus*) *multicolor* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 123 (Brazil: Rio de Janeiro); Pl. 43, figs. 73–74 (specimen).

Gonyostomus multicolor Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, pp. vi (animal; anatomy; jaw; radula) and viii; Pl. 49, fig. 8; Pl. 50, fig. 15; Pl. 52, figs. 26–27; Pl. 53, fig. 35; Pl. 57, figs. 65–67.

The present location of Rang's type of *H. multicolor* is unknown. It was not found at the Paris Museum (E. Fischer, *in litt.*, 1946).

Specimens Examined. BRAZIL: several without more definite locality (M.C.Z.; U.S.N.M.; M.U.Mich.). Corcovado near Rio de Janeiro (D. Bourget. — M.C.Z.; Ac.N.S.Phila.). Rio de Janeiro (A.M.N.H.).

This species is definitely known from the states of Rio de Janeiro and São Paulo, where Rang states he collected it himself. There are, however, only two precise locality records, both from the state of Rio de Janeiro. The species is common enough in collections, but as a rule merely labelled "Brazil".

The sculpture is much finer in this species than in the others; that of the nepionic whorls wears away rapidly, the summit being often almost smooth in adult shells. The granules are extremely fine, particularly on the terminal half of the body-whorl, portions of which are sometimes smooth. In the typical form of the species, the aperture is relatively narrow, with the outer lip narrow and moderately reflexed; the white, porcelain-like markings spread over the whole of the whorls, being usually more extensive than the brown areas. Peristome bright rose-colored, exceptionally white (probably faded).

Rang gave as original measurements: length, 35 mm.; width, 19 mm.; his figure is, however, 36 mm. long, 16 mm. in greatest width, the aperture 20 by 7 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
38.5 mm.	16	15	21	8	5⅓	Brazil
37	16	15	20	7	5⅓	Corcovado
36	16	14.5	20	7.5	5⅓	“
35	16	15	19.5	7	5⅓	“
34	14.5	13	17.5	7	5	Brazil
33	15	13	19	6.5	5	“

Original description of *H. multicolor* (French text translated): “Testa ovato-conica, perforata, tenuissime striata, albo, luteo, bruneo nigroque irregulariter variegata; apice subacuta, flavescente; ultimo anfractu magno; apertura oblonga; columella alba; labro lato, reflexo, purpureo; intus coerulea. Shell ovate-conical, thin, yet not at all transparent. Surface marked with very fine longitudinal [=vertical] striae, crossed by transverse [=spiral] even finer striae, visible only with a lens. Covered with a barely noticeable periostracum, through which may be seen white, yellow, brown and black, combined so as to form a crowded assemblage of varied, irregular spots; the spots pale near the summit, which is light yellow, and well marked and darker over the body-whorl. Summit almost acute; whorls 5½ in number, tolerably rounded and with parallel sutures; body-whorl larger than the others combined. Aperture oblong, its direction parallel with the axis and its plane fairly oblique. Columella white; columellar margin and right margin [=outer lip] expanded, reflexed and beautifully purple; inside dark blue, somewhat lacquered.”

b. G. MULTICOLOR MIERSII (Sowerby)

Pl. 2, figs. 1, 2

Bulinus miersii Sowerby, 1838 (before October 31), Conchol. Illustr., *Bulinus*, figs. 90 (2 figs.) of Pt. 144 (no locality; name in original letterpress list published with this part; name spelled “*B. myersii*” in revised list of 1841). Not *Bulinus myersii* Sowerby, 1838 (October 31), of Pt. 145.

Bulimus myersii Reeve, 1842, Conch. Syst., **2**, p. 81; Pl. 174, figs. 90 (2 figs.; copies of Sowerby's figures of 1838). Catlow and Reeve, 1845, Conchologist's Nomenclator, p. 157.

Bulimus miersii Reeve, 1848, Conch. Icon., **5**, *Bulimus*, Pl. 39, fig. 239. Jay, 1850, Cat. Shells Coll., 4th Ed., p. 201. Deshayes, 1851, in Férussac, Hist. Nat. Moll. Terr. Fluv., **2**, pt. 2, p. 53; Atlas, Pl. 130, figs. 7–8 (Expl. of Plates, p. 19). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 333; 1854, Syst. Conch. Cab., **1**, Abt. 13, p. 1, p. 146; Pl. 45, figs. 20–21. Hupé, 1857, Anim. Nouv. Rares Expéd. Amér. Sud de Castelnau, **3**, Moll., p. 56. Pfeiffer, 1859, Monogr. Helic. Viv., **4**, p. 396; 1868, *Op. cit.*, **6**, p. 42. Haines, 1868, Cat. Terr. Shells Coll., p. 51. Hidalgo, 1870, Jl. de Conchyl., **18**, p. 47 (Brazil: Rio de Janeiro). Paetel, 1873, Cat. Conch.-Samml., p. 98. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 54. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., p. 214. Hidalgo, 1900, Mem. Ac. Cienc. Madrid, **19**, (1893–1900), p. 94.

Bulimus multicolor var. β Pfeiffer, 1848, Monogr. Helic. Viv., **2**, p. 43.

Bulimus (*Anthinus*) *miersii* Albers, 1850, Die Heliceen, p. 148. Pfeiffer, 1856, Malak. Blätt., **2**, (1855), p. 149. v. Martens, 1860, in Albers, Die Heliceen, 2d Ed., p. 189. Pfeiffer, 1879, Nomencl. Helic. Viv., p. 221.

Otostomus (*Anthinus*) *miersii* H. and A. Adams, 1855, Gen. Rec. Moll., **2**, p. 150.

Auris (*Gonyostomus*) *multicolor* var. *miersii* Pilsbry, 1896, Man. of Conch., (2), **10**, p. 124; Pl. 43, figs. 71–72 (specimen).

Gonyostomus miersii Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, p. viii.

Sowerby's type of *miersii* may be at the British Museum, although it was not traced there.

Specimens Examined. BRAZIL: several without more definite locality (Ac.N.S.Phila.; M.C.Z.; M.U.Mich.; A.M.N.H.; U.S.N.M.). Rio de Janeiro, two specimens (Ac.N.S.Phila.; U.S.N.M.). Piquete, Est. São Paulo (H. v. Ihering. — Ac.N.S.Phila.).

The distribution of *miersii* is as yet little known, the only definite localities recorded thus far being Rio de Janeiro and Piquete.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture		Whorls	
			Length	Width		
47 mm.	20	16	25	8	5½	Brazil
45	20	16.5	23	9	5½	“
42	19.5	16	22	7.5	5½	“
39	17.5	14.5	20.5	6.5	5½	“
38	17	14	19.5	7	5½	“
37	14.5	13	17.5	6.5	5½	Piquete
35	15	12.5	18	6.5	5½	Brazil
32.5	15	13	17	6.5	5⅓	“

To judge from the material seen, *miersii* is only subspecifically distinct from *G. multicolor*. Pilsbry stated at first (1896): “I see no sufficient grounds for separating this specifically from *A. multicolor*;” but he later (1902) listed it, without comment, as a distinct species.

It differs strikingly from typical *multicolor* in color, the body-whorl bearing a broad corneous-brown peripheral band, much lighter than the brown areas above and below it; in this median zone the white porcelain-like markings are usually faint, except toward the outer lip. In addition, the shell is stouter; the sculpture is even finer than in typical *multicolor*; and the aperture is broader, with a more expanded outer lip, the rim of which is recurved. The outer lip is rose-colored, often brightly so.

Sowerby's figure of the type measures: length, 43 mm.; greatest width, 19 mm.; aperture, 22 by 9 mm.

GONYOSTOMUS (ANTHINUS) TURNIX (Gould)

a. Typical TURNIX

Pl. 4, fig. 6; Pl. 14, fig. 4; Pl. 21, fig. 2; Pl. 26, fig. 4

Bulimus turnix Gould, 1846 (January), Proc. Boston Soc. Nat. Hist., **2**, p. 101 (Brazil: Organ Mts., Est. Rio de Janeiro); 1862, Otia Conchol., p. 199 (Brazil ?). Pfeiffer, 1853, Monogr. Helic. Viv., **3**, p. 315; 1859, *Op. cit.*, **4**, p. 395; 1868, *Op. cit.*, **6**, p. 41. Haines, 1868, Cat. Terr. Shells Coll., p. 57. Pfeiffer, 1876, Monogr. Helic. Viv., **8**, p. 53. Paetel, 1889, Cat. Conch.-Samml., 4th Ed., **2**, p. 218.

Bulimus (? *Strophocheilus*) *turnix* Pfeiffer, 1879, Nomencl. Helic. Viv., p. 223.

Auris (*Gonyostomus*) *turnix* Pilsbry, 1901, Man. of Conch., (2), **14**, p. 133; Pl. 18, figs. 53–55 (2 specimens. Brazil: Serra da Bocaina, Est. São Paulo).

Gonyostomus turnix Pilsbry, 1902, Man. of Conch., (2), **14**, Classification, pp. vi (anatomy) and viii; Pl. 51, fig. 16; Pl. 54, fig. 37; Pl. 57, figs. 59 and 68.

Bulimus (*Gonyostomus*) *centiquadrus* ["Valenc." Beck, 1837, Index Moll., pt. 1, p. 53. "Paraguay"; *nomen nudum*] Ancey, 1906, Jl. de Conchyl., **53**, p. 319 (specimen in Paris Museum, labelled *centiquadrus* by Valenciennes, is *turnix* Gould; locality appears doubtful).

Gould's type was never figured and its present location is unknown. Gould originally stated that the specimen was presented to the Boston Society of Natural History by Mrs. A. H. Everett; but it is not to be found there now, nor could it be traced. It is likewise absent from the Gould Collection, which was acquired by the New York State Museum in Albany.[1] At first Gould gave the definite locality "Organ Mts."; but he later (1862) changed this to "Brazil", with a query.

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[1] *B. turnix* is not included in the list of Gould's types acquired by the New York State Museum (1875, 27th Ann. Rept. New York State Mus., for 1873, pp. 47–55).

Specimens Examined. BRAZIL: Three without more definite locality (Ac.N.S.Phila.; M.C.Z.). Itatiaya, Est. Rio de Janeiro (F. Schade. — M.C.Z.). Organ Mountains near Rio de Janeiro (A.M.N.H.). Rio de Janeiro (F. Schade. — M.C.Z.). Serra da Bocaina, Est. São Paulo (H. v. Ihering. — Ac.N.S.Phila.). Piquete, Est. São Paulo (M.C.Z.). Alegre, Est. Espírito Santo (M.U.Mich.).

G. turnix seems to be more widespread than the other species of the genus, the typical form being known definitely from the states of Rio de Janeiro, São Paulo, and Espírito Santo.

G. turnix is the broadest and most capacious member of the genus. The aperture is very large, nearly half of the total length of the shell. In general shape it resembles some of the smaller species of *Strophocheilus*, such as *S. pudicus*, but is much thinner. It is also more flattened dorso-ventrally than usual in *Gonyostomus.* The nepionic sculpture and color pattern refer it, however, to *Gonyostomus.* The surface of the body-whorl is coarse, owing to the dense granulation, very unequal in size, but placed in somewhat wavy and crowded spiral rows, extending to near the outer lip. The aperture is much widened over the basal half, with the outer lip thin, greatly expanded and with reflexed rim. The color markings consist of irregular vertical rows of yellowish white blotches on a pale brown background, producing a very irregular checkered pattern. The paler areas are not appreciably thickened, nor porcelain-like. Gould described the outer lip as roseate and Pilsbry's specimen from Serra da Bocaina had it orange-colored. Pilsbry also saw a specimen at A.M.N.H., supposedly from the type locality, with a white outer lip. The five specimens I have seen, apparently all in fresh condition, have the outer lip and columella either white or slightly dull orange.

Gould's original measurements are: length, 2⅕ inches [=55.8 mm.]; diameter, 11/10 by 9/10 inches [=28 by 23 mm.]; aperture, 1 3/10 inches [=33 mm.]. Pilsbry's two specimens were respectively 48 and 50 mm. long; 25 and 27.5 mm. in greatest width; with the longest axis of the aperture 29 and 32.5 mm.

Measurements of Adult Shells

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
53 mm.	28	21.5	35	15	5	Brazil
52	28	20	33	12.5	5	Itatiaya
50.5	27.5	21	29.5	12	5	Rio de Janeiro
48	27	21.5	31	12	5	Alegre

b. G. TURNIX ALBOLABIATUS Jaeckel

Pl. 20, fig. 5

Gonyostomus turnix var. *albolabiatus* Jaeckel, 1927, Zoolog. Anzeiger, **72**, p. 136 (Brazil: Sa. Rosa near Uruguayana, Est. Rio Grande do Sul).

Cotypes of var. *albolabiatus* were said by the author to be in his collection and at the Berlin Museum. Some of them were evidently sent to the Departamento de Zoologia in São Paulo and one of these was presented to the M.C.Z. by Dr. Oliveiro M. de Oliveira Pinto.

Specimen Examined. BRAZIL: Sa Rosa near Uruguayana, Est. Rio Grande do Sul, paratype (Müllegger. — M.C.Z. No. 179248).

This form differs from typical *turnix* in shape, having a much more slender outline, a narrower spire, and a smaller and narrower aperture. The white peristome is scarcely a valid character, as it occurs also in some otherwise typical *turnix*. I cannot see that the whorls are any flatter than in the typical race.

Measurements of Adult Shell

Length	Width in front view	Width in profile	Aperture Length	Aperture Width	Whorls	
46 mm.	24	18	25.5	11	5	Uruguayana, paratype

INDEX[1]

abbreviatus, Strophocheilus granulosus 17, 58, **164**; Pl. 27, fig. 4
Acavacea 4, 13, 14, 15
Acavidae 4, 13
accelerans, Bulimus 17, 110
Achatinidae 14, 15
alba, Bulimus oblonga var. 17, 73
alba, Strophocheilus oblonga var. 73
albescens, Strophocheilus oblongus 17, 60, **73**
albolabiata, Bulimus oblongus var. 17, 72
albolabiatus, Strophocheilus oblongus var. 72
albolabiatus, Gonyostomus turnix 17, **202**; Pl. 20, fig. 5
albus, Bulimus 72
albus, Bulimus oblongus var. 17, 72
albus, Bulinus 72
albus, Strophocheilus oblongus 17, 18, 21, 55, **72**; Pl. 10, fig. 5; Pl. 22, fig. 2
almeida, Bulimus 30, 31
almeida, Strophocheilus 18, 30
almeida, Strophochilus 31
Anthinus 10, 14, 189, **196**
argenteus, Euritus 26
atavus, Strophocheilus 18, **47**; Pl. 8, fig. 3
Auris 188
auris-leporis, Bulimus 190
auris-leporis, Cochlorina 190
auritus, Bulimus 144
auritus, Bulinus 18, 144
auritus, Strophocheilus 18, 22, **144**; Pl. 4, fig. 1; Pl. 26, fig. 3
australis, Bulimus lutescens var. 18, 173
australis, Partula 18, 30
australis, Strophocheilus lutescens var. 173

Borus 54, 107
bridgesi, Bulimulus 186
bridgesi, Orthalicus 186
bridgesii, Bulimus 18, 186
bridgesii, Strophocheilus 18, 178, **186**; Pl. 13, figs. 2, 3; Pl. 14, fig. 3
bronni, Borus 156
bronni, Bulimus 18, 155
bronni, Strophocheilus 18, 19, 21, 58, **155**; Pl. 5, fig. 3; Pl. 22, fig. 1; Pl. 32, fig. 2
browni, Bulimus 18, 156
bucki, Zonocopris 62
Bulimulidae 4, 13, 26, 188
Bulimulus 169
Bulimus 54, 62, 104
Bulinus 11
Burtoa 15, 24

cacopatensis, Strophocheilus 18, 126
calus, Strophocheilus 18, 21, 28, **34**; Pl. 17, fig. 5; Pl. 19, fig. 3; Pl. 32, fig. 5
cantagallana, Helix 18
cantagallanus, Borus 109, 156
cantagallanus, Bulimus 109, 115, 152
cantagallanus, Strophocheilus 109
capillaceus, Borus 120
capillaceus, Bulimus 18, 120
capillaceus, Bulimus oblongus var. 120
capillaceus, Strophocheilus 18, 56, 68, **120**; Pl. 14, fig. 5
carnatis, Melania 18, 67

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[1] Synonyms are printed in *italics;* new names proposed in this paper and main references in **bold face.**

carrikeri, Strophocheilus 18, 57, **124**; Pl. 2, fig. 6; Pl. 6, fig. 4; Pl. 7, fig. 3; Pl. 30, fig. 2
Caryodidae 4
castelnaudi, Bulimus 18, 129
castelnaui, Bulimus 18, 129
castelneaui, Bulimus 129
centiquadrus, Bulimus 18, 190, 200
chilensis, Bulimulus 182
chilensis, Bulimus 182
chilensis, Bulinus 18, 182
chilensis, Strophocheilus 18, 20, 21, 177, **182**; Pl. 11, figs. 1, 2, 3
Chiliborus 27, **176**
chionostoma, Bulimus 18, 152
chionostoma, Bulimus ovatus var. 152
chionostoma, Strophocheilus ovatus 18, 58, **152**; Pl. 8, fig. 6
christiana, Helix 18, 25
christiani, Bulimus 18, 25
chubutensis, Strophocheilus 18, **48**
chubutiensis, Megalobulimus 48
Clavator 15
Clavatoridae 4, 15
cocapatensis, Bulimus 18, 126
cocapatensis, Strophocheilus 18, 55, **126**
Cochlorina 190
cocopatensis, Strophocheilus 18, 127
compressus, Bulimus 18, 25
concolor, Bulimus 18, 190
Coniclus 27
conicus, Strophocheilus oblongus 18, 56, **79**; Pl. 6, fig. 1; Pl. 19, fig. 2; Pl. 23, figs. 1, 3
connectens, Borus popelairianus var. 100
connectens, Bulimus popelairianus var. 18, 100
connectens, Strophocheilus popelairianus var. 100
contortuplicatus, Bulimus 18, 36
contortuplicatus, Plekocheilus 36
contortuplicatus, Strophocheilus 18, 28, **36**; Pl. 8, fig. 1
corapatensis, Bulimus 18, 126
cordillerae, Bulimus lutecens var. 18, 174
cordillerae, Bulimus lutescens var. 175
cordillerae, Strophocheilus 18, 19, **174**, 175
cordillerae, Strophocheilus lutescens var. 175
corrugatus, Bulimus 18, 108
corrugatus, Bulimus ovatus var. 108
Corus 54
crassa, Bulimus oblonga var. 18, 74
crassilabris, Bulimus oblongus var. 18, 75
crassus, Borus oblongus var. 78
crassus, Strophocheilus oblongus var. 74
credulatus, Bulimus 18, 183
crenellus, Bulimus 15, 169
crenulatus, Borus 183
crenulatus, Bulimus 18, 182, 183
crenulatus, Orthalicus 183
crenulatus, Strophocheilus 183

dalmasi, Plecochilus 26
debilis, Strophocheilus pudicus 18, 28, **34**; Pl. 16, fig. 1; Pl. 17, fig 2
dohrnianus, Bulimus popelairianus var. 18, 100
dohrnianus, Strophocheilus popelairianus var. 100
dohrniensis, Bulimus popelairianus var. 18, 100
dorbignyi, Strophocheilus 172
dorbignyi, Strophocheilus lutescens var. 18, 172
d'orbignyi, Borus 172
d'orbignyi, Bulimus 18
d'orbignyi, Strophocheilus 18, 20, 168, **172**; Pl. 12, fig. 4; Pl. 32, figs. 6, 7
Dorcasiidae 4
Dryptus 13, 25
durfeldti, Strophocheilus 129

dürfeldti, Bulimus 18, 129

Edentulina 154
egregia, Pupa 194
egregius, Bulimus 19, 194
egregius, Gonyostomus 19, 189, **194**; Pl. 3, fig. 2; Pl. 11, fig. 4; Pl. 14, fig. 2; Pl. 28, fig. 4
egregius, Otostomus 194
elongatus, Strophocheilus oblongus 19, 56, 60, **78**; Pl. 1, fig. 4; Pl. 2, fig. 4
erubescens, Bulimus 19, 192
erubescens, Helix 19, 30
erythrosoma, Strophocheilus 19, 21, 29, **45**; Pl. 9, fig. 5; Pl. 16, fig. 6
eyerdami, Strophocheilus sancti-pauli 19, 57, **139**; Pl. 24, fig. 2

felipponei, Strophocheilus 19, 143’ 144
foreli, Strophocheilus granulosus 19, 58, **165**; Pl. 28, fig. 3
fossilis, Borus rimanni var. 18, 175
fragilior, Strophocheilus 19, 159
fragilior, Strophocheilus bronni 19, 58, **159**; Pl. 21, fig. 1
fulguratus, Bulimus 19, 106
fusoides, Strophocheilus planidens 19, 28, **43**; Pl. 9, fig. 2; Pl. 12, fig. 2; Pl. 25, fig. 2

garcia-moreni, Borus 19, 100
Geotrupes 62
globosus, Bulimus 19, 142
globosus, Strophocheilus 19, 57, **142**; Pl. 4, fig. 7; Pl. 15, fig. 2; Pl. 20, fig. 2
Goniostoma 190
goniostoma, Auricula 191
goniostoma, Auris 191
goniostoma, Bulimus 191
goniostoma, Cochlogena 191
goniostoma, Cochlorina 191
goniostoma, Gonyostomus 19, 20, 189, **190**; Pl. 13, fig. 1; Pl. 16, fig. 2; Pl. 20, fig. 4; Pl. 23, fig. 2; Pl. 28, fig. 5
goniostoma, Helix 19, 191
goniostoma, Otostomus 191, 192
goniostoma, Pupa 191
Goniostomus 190
gonostomus, Bulimus 19, 192
Gonyostoma 190
Gonyostomus **186**; 189, **190**
Gonyotomus 190
grandis, Bulimus 19, 154
grandis, Pupa 154
grandis, Strophocheilus ovatus 19, 20, 58, **154**; Pl. 6, fig. 5; Pl. 9, fig. 8; Pl. 14, fig. 6; Pl. 25, fig. 5; Pl. 30, fig. 1
granulosa, Helix 19, 160
granulosus, Borus 161
granulosus, Bulimus 160, 161
granulosus, Strophocheilus 19, 20, 21, 156, **160**, 161; Pl. 12, fig. 5; Pl. 14, fig. 1; Pl. 29, fig. 4; Pl 32, fig. 3
grossus, Bulimus 19, 25
gummatus, Bulimus 19, 115
gummatus, Strophocheilus 115
gummatus, Strophocheilus terrestris 19, 56, **115**; Pl. 17, fig. 6

haemastoma, Borus 68
haemastoma, Bulinus 68, 74, 82
haemastomus, Bulimus 19, 67, 68, 74, 149, 161
haemastomus, Bulinus 149
haemastomus, Helix 68
haemastomus, Strophocheilus 27
haemastomus, Strophocheilus oblongus 18, 19, 20, 56, 60, **74**; Pl. 6, fig. 2; Pl. 21, fig. 4; Pl. 24, fig. 5
haemastomus, Turbo 74
hanleyi, Synapterpes 193
hauthali, Strophocheilus 19, **119**
hector, Bulimus 19, 118

hector, Strophocheilus 19, **118**
hector, Thaumastus 118
hemastomus, Bulimus 19, 67
hemostomus, Bulimus 68
huascari, Bulimus 19, 95
huascari, Bulimus maximus var. 95
huascari, Strophocheilus 95, 135
huascari, Strophocheilus maximus 19, 20, 21, 56, **95**; Pl. 29, fig. 3
hupeanus, Bulimus 19, 129
hupeanus, Strophocheilus 129
hybrida, Auris 194
hybrida, Gonyostomus 194
hybridus, Bulimus 19, 194
hybridus, Goniostomus 194

iguapensis, Strophocheilus milleri 19, **52**; Pl. 1, fig. 2; Pl. 26, fig. 5
iguapensis, Strophocheilus ovatus 19, 139
iheringi, Bulimus 19, 166
iheringi, Strophocheilus 166
imperialis, Limnaea 19, 149
incarum, Megalobulimus 19, 25, 168
indentatus, Strophocheilus 19, 26
indigens, Strophocheilus 19, **98**; Pl. 24, fig. 1
intercedens, Bulimus 19, 110
intercedens, Strophocheilus cantagallanus var. 110
intertextus, Streptocheilus capillaceus 84
intertextus, Strophocheilus 19, 56, **84**; Pl. 18, fig. 3
intertextus, Strophocheilus capillaceus var. 19, 84

jaussaudi, Coniclus 19, 41
jaussaudi, Strophocheilus planidens 19, 28, **41**; Pl. 21, fig. 3
jenksianus, Strophocheilus 19, 123

kremnoica, Helix 19, 90
kremnoicus, Bulimus 90, 94
kremnoicus, Strophocheilus maximus var. 94
kronei, Strophocheilus milleri 19, **50**; Pl. 7, fig. 1; Pl. 20, fig. 3; Pl. 32, fig. 1

lacunarum, Bulimus 19, 132
lacunosus, Bulimus 129, 131, 132
lacunosus, Helix 19, 131
lacunosus, Strophocheilus leucostoma 19, 21, 57, **131**; Pl. 13, fig. 5; Pl. 15, fig. 3
latescens, Bulimus 170
laxata, Macrocyclis 61
leucostoma, Bulimus 127, 128
leucostoma, Bulinus 19, 127
leucostoma, Helix pudica var. 19, 29
leucostoma, Strophocheilus 19, 20, 21, 57, **127**; Pl. 7, fig. 2; Pl. 10, figs. 1, 2; Pl. 12, fig. 3; Pl. 23, fig. 4; Pl. 31, fig. 2
Leucotaenius 15
lichensteini, Strophocheilus 87
lichtensteini, Bulimus 19, 86, 87
lichtensteini, Strophocheilus 19, 21, 56, **86**; Pl. 1, fig. 1; Pl. 10, fig. 1
Lophocheilus 54
lorentzianus, Borus 80, 81
lorentzianus, Borus oblongus var. 80
lorentzianus, Bulimus 20, 80
lorentzianus, Strophocheilus 80
lorentzianus, Strophocheilus oblongus 20, 56, 60, **80**; Pl. 27, fig. 5
lorenzianus, Bulimus 20, 80
lorenzianus, Strophocheilus 81
lutecens, Bulimus 20, 170
lutescens, Bulimus 169, 170
lutescens, Bulinus 20, 143, 169
lutescens, Megalobulimus 170
lutescens, Orthalicus 170
lutescens, Strophocheilus 20, 168, **169**, 173; Pl. 6, fig. 7; Pl. 27, figs. 2, 3

mabillei, Bulimus 26

Macrocyclidae 4, 13
Macrocyclis 61
magohani, Bulinus 129
mahogani, Bulimus 128, 129
mahogani, Bulinus 20, 128
major, Bulimus lorentzianus var. 80
major, Bulimus rosaceus var. 20, 179
martensianus, Strophocheilus 20, 154
mathewsii, Bulimus 20, 128
mathieusii, Strophocheilus 20, 128
mathiusii, Borus 128
mathiusii, Bulimus 128
mathiusii, Helix 20, 128
mathiusii, Strophocheilus 128
matthewsii, Bulimus 20, 128
maxima, Cochlogena 20, 90
maxima, Bulimus d'orbignyi var. 20, 172
maximus, Borus 90
maximus, Bulimus 90, 95, 99
maximus, Bulimus popelairianus var. 99
maximus, Bulinus 90
maximus, Strophocheilus 19, 20, 21, 56, **89**, **90**; Pl. 3, fig. 5; Pl. 21, fig 5
Megabulimus 54
Megalobulimus 26, **54**
Metachatina 15
Microborus 26, **167**
miersi, Strophocheilus 20, 28, **37**; Pl. 26, fig. 1; Pl. 27, fig. 1; Pl. 31, fig. 3
miersii, Auris multicolor var. 199
miersii, Bulimus 198, 199
miersii, Bulinus 20, 198
miersii, Gonyostomus multicolor 20, 189, **198**; Pl. 2, figs. 1, 2
miersii, Otostomus 199
milleri, Bulimus 49
milleri, Bulinus 20, 49
milleri, Strophocheilus 19, 20, **49**; Pl. 22, fig. 4; Pl. 31, fig. 5
minima, Bulimus d'orbignyi var. 20, 172
minor, Borus oblongus var. 20, 81
minor, Borus popelairianus var. *connectens* form 100
minor, Bulimus lorentzianus var. 20, 80
minor, Bulimus maximus var. 20, 95
minor, Bulimus rosaceus var. 20, 182
multicolor, Auris 197
multicolor, Bulimus 196, 197, 199
multicolor, Bulinus 196
multicolor, Gonyostomus 20, 189, **196**; Pl. 4, fig. 5; Pl. 9, figs. 3, 7; Pl. 13, fig. 6; Pl. 17, fig. 4
multicolor, Helix 20, 196
musculus, Strophocheilus oblongus 20, 56, 60, **82**; Pl. 12, fig. 6; Pl. 20, fig. 1; Pl. 31, fig. 4
myersii, Bulimus 20, 198
myersii, Bulinus 20, 31

nana, Bulimus proximus var. 20, 95
navicula, Helix 190
neogaeus, Bulimus 20, 75
Neopetraeus 177
nucleus, Bulimus 170, 172
nucleus, Bulimus lutescens var. 170
nucleus, Bulinus 20, 170, 172, 173

oblonga, Cochlogena 65
oblonga, Helix 20, 63, 65, 149, 161
oblongus, Borus 66
oblongus, Bulimus 63, 65, 67, 74, 82, 84
oblongus, Lophocheilus 67
oblongus, Strophocheilus 17, 18, 19, 20, 21, 22, 55, **58**, 59, **63**, 66, 67; Pl. 1, fig. 5; Pl. 2, figs. 3, 5; Pl. 18, fig. 4; Pl. 23, fig. 5; Pl. 28, fig. 1; Pl. 32, fig. 8
oblongus, Strophochilus 66, 67
occidua, Bulla 20, 67
oliveirai, Strophocheilus terrestris 20, 56, **117**; Pl. 5, fig. 2
Onthocharis 62
oosomus, Strophocheilus 20, 114

oosomus, Strophocheilus terrestris 20, 56, **114**; Pl. 5, fig. 1
orbignyi, Borus 20, 172
orbignyi, Bulimus 172
Otis 27
ovalis, Bulinus 148
ovalis, Helix 20, 68, 148, 156
ovata, Cochlogena 148
ovata, Helix 20, 147, 148, 152, 156
ovatus, Borus 148
ovatus, Bulimus 68, 145, 147, 148, 152, 156
ovatus, Strophocheilus 19, 20, 58, 68, **146**, **147**, 148; Pl. 7, fig. 4; Pl. 16, fig. 5
ovipara, Helix 20, 67, 148
ovum, Bulimus 20, 149
ovum, Helix 20, 149

pachycheilus, Bulimus 20, 185
pachychilus, Bulimus 20, 184, 185
pachychilus, Strophocheilus 20, 177, **184**; Pl. 8, figs. 2, 4
papyraceus, Limnaeus 20, 192
paranaguensis, Strophocheilus 20, 164
paranaguensis, Strophocheilus granulosus 20, 58, **164**; Pl. 5, fig. 4; Pl. 26, fig. 2; Pl. 30, fig. 4
particeps, Strophocheilus rosaceus var. 20, 179
perelongatus, Strophocheilus oblongus 21, 56, 60, **77**; Pl. 22, fig. 3
pergranulatus, Strophocheilus bronni 21, 58, **158**; Pl. 13, fig. 8; Pl. 24, fig. 4
perplexus, Bulimus 31
perplexus, Bulinus 21, 31
pilsbryi, Strophocheilus 21, **53**; Pl. 4, fig. 3; Pl. 6, fig. 6; Pl. 17, fig. 3; Pl. 29, fig. 1
planidens, Bulimus 21, 39, 40
planidens, Helix 39
planidens, Strophocheilus 19, 21, 28, **39**, 40; Pl. 1, fig. 3; Pl. 12, fig. 1; Pl. 18, fig. 2; Pl. 25, fig. 1; Pl. 32, fig. 4
Plekocheilus 26
popelairiana, Bulimus 21, 98
popelairianus, Borus 99
popelairianus, Bulimus 99, 106
popelairianus, Strophocheilus 18, 19, 21, 22, 56, 91, **98**, 99; Pl. 11, fig. 5
popelairianus, Strophochilus 99
popolairianus, Strophocheilus 21, 99
porphyrostoma, Strophocheilus 21, 45
potiezi, Bulimus 21, 179
proclivis, Bulimus 21, 166
proclivis, Strophocheilus 19, 21, 58, **166**; Pl. 19, fig. 5; Pl. 28, fig. 2
proximus, Bulimus 110
proximus, Bulinus 21, 109
Pseudoclavator 15
pudica, Helix 21, 29
pudica, Partula 29
pudicus, Bulimus 29, 30, 33, 35, 45
pudicus, Strophocheilus 18, 19, 20, 21, 22, 28, **29**, 30, 45; Pl. 4, fig 4; Pl. 8, fig. 5; Pl. 9, fig. 4; Pl. 16, fig. 3; Pl. 19, fig. 1
pulcherrimus, Drymaeus 189
pygmaeus, Strophocheilus sanctipauli 21, 57, **138**; Pl. 15, fig. 5

rhodocheilus, Bulimus 21, 25
rhodochilus, Bulimus 21
rhodostoma, Helix 34
rhodostoma, Helix pudica var. 21, 34
rimanni, Borus 21, 175
rosacea, Helix 178
rosaceus, Borus 179
rosaceus, Bulimus 120, 178, 179, 182
rosaceus, Bulinus 21, 178
rosaceus, Otis 21, 30
rosaceus, Strophocheilus 20, 21, 177, **178**; Pl. 10, fig. 3; Pl. 15, fig. 1; Pl. 16, fig. 4; Pl. 25, fig. 3; Pl. 29, fig. 2
rosasceus, Bulinus 21, 178
rosea, Ampullaria 21, 68

roseolabris, Strophocheilus pudicus 21, 28, **33**; Pl. 3, fig. 3; Pl. 24, fig. 3
roseus, Bulimus 21, 67
rugosus, Strophocheilus 21, 132

sancta-cruzii, Bulimus 21, 135
sanctae-catharinae, Bulimus haemastomus var. 21, 161
sanctae-crucis, Bulimus 21, 95, 132
sanctaepauli, Strophocheilus oblongus var. 21, 137
sancti-josephi, Strophocheilus 21, **175**
sanctipauli, Strophocheilus 21, 57, **137**; Pl. 13, fig. 7
santacruzensis, Bulimus 21, 132, 135
santa-cruzii, Bulimus 132, 135
santa-cruzii, Helix 21, 135
santa-cruzii, Strophocheilus 21, 57, 132, **135**; Pl. 30, fig. 3
semilineata, Helix 21, 68
semilineatus, Bulimus oblongus var. 68
semimalleatus, Strophocheilus 21, 88
semimalleatus, Strophocheilus lichtensteini 21, 56, **88**; Pl. 3, fig. 1; Pl. 4, fig. 2
seneri, Borus 21, 181
seneri, Bulimus 181
seneri, Strophocheilus capillaceus var. 181
seneri, Strophocheilus rosaceus 21, 177, **181**; Pl. 31, figs. 1, 6
separabilis, Strophocheilus 19, 21, 57, **123**; Pl. 3, fig. 4; Pl. 9, fig. 1; Pl. 17, fig. 1
serpentina, Helix 61
sinistralis, Bulimus lacunosus form 21, 129
Speironepion 14, 26, **48**
squammulatus, Bulimus 21, 182
st.-crucis, Bulimus 21, 135
Streptocheilus 55
Strophocheilidae 4, 5, 9, 10, 12, **13**, 14, 16, 118
Strophocheilinae 13
Strophocheilos 119
Strophocheilus **22**, 26, **27**
Strophochilus 27
Stropocheilus 27
subhybridus, Gonyostomus 21, 189

terrestris, Bulimus 21, 108
terrestris, Bulimus ovatus var. 108
terrestris, Strophocheilus 17, 18, 19, 20, 21, 56, **108**; Pl. 7, fig. 5; Pl. 18, fig. 1
thammianus, Borus popelairianus var. 100
thammianus, Bulimus popelairianus var. 21, 100
thammianus, Strophocheilus popelairianus var. 100
Thaumastus 13, 118
tobagoensis, Strophocheilus oblongus var. 21, 72
topelairianus, Bulimus 22, 99
toriii, Megalobulimus 22, 141
toriii, Strophocheilus yporanganus 22, 57, **141**; Pl. 25, fig. 4
turnix, Auris 200
turnix, Bulimus 22, 200
turnix, Gonyostomus 22, 189, **200**; Pl. 4, fig. 6; Pl. 14, fig. 4; Pl. 21, fig. 2; Pl. 26, fig. 4
Tylotoma 119

unidentata, Partula 22, 43, 44
unidentatus, Bulimus 43, 44
unidentatus, Coniclus 42
unidentatus, Strophocheilus 22, 28, **43**, 44; Pl. 6, fig. 3; Pl. 9, fig. 6

valenciennensi, Corus 22, 105
valenciennesii, Borus 100
valenciennesii, Bulimus 22, 100, 105
valenciennesii, Bulimus popelairianus var. 105

valenciennesii, Strophocheilus 19, 22, 56, **105**; Pl. 15, fig. 4; Pl. 20, fig. 6
valensiennesi, Bulimus 22, 105
vaporeus, Bulimus 22, 68
versatilis, Strophocheilus 22, 145
versicolor, Bulimus 22, 189
versicolor, Gonyostomus 22, 189
vestitus, Strophocheilus kremnoicus 22, 94
vestitus, Strophocheilus maximus 22, 56, **94**; Pl. 19, fig. 4
virgineum, Ellobium 30
virgineus, Bulimus 22, 30

yporanganus, Strophocheilus 19, 22, 57, **139**; Pl. 13, fig. 4

Zaplagius 190
Zonocopris 62

PLATES

PLATE 1

PLATE 1

Fig. 1. *Strophocheilus lichtensteini* (Albers). Bellavista. M.C.Z. 31629.

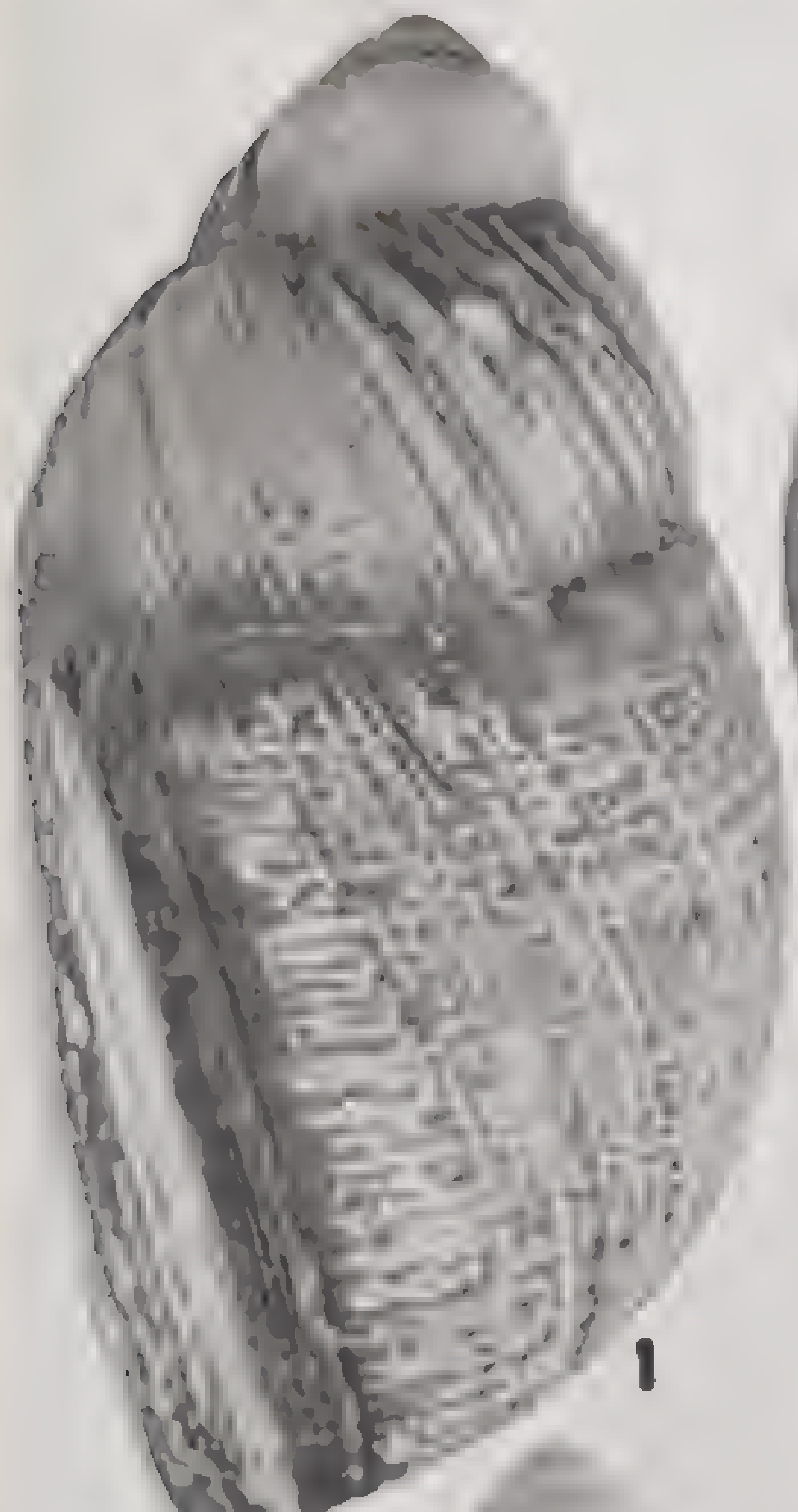
Fig. 2. *Strophocheilus milleri iguapensis* Pilsbry. Holotype. Iguapé. Ac.N.S.Phila. 30343.

Fig. 3. *Strophocheilus planidens* (Michelin). Brazil. M.C.Z.

Fig. 4. *Strophocheilus oblongus elongatus* J. Bequaert. Paratype. Nueva Palmira. U.S.N.M. 381573.

Fig. 5. *Strophocheilus oblongus* (O. F. Müller). Abnormal. Encontrados. N.H.M.Chic. 11724.

All Natural Size.



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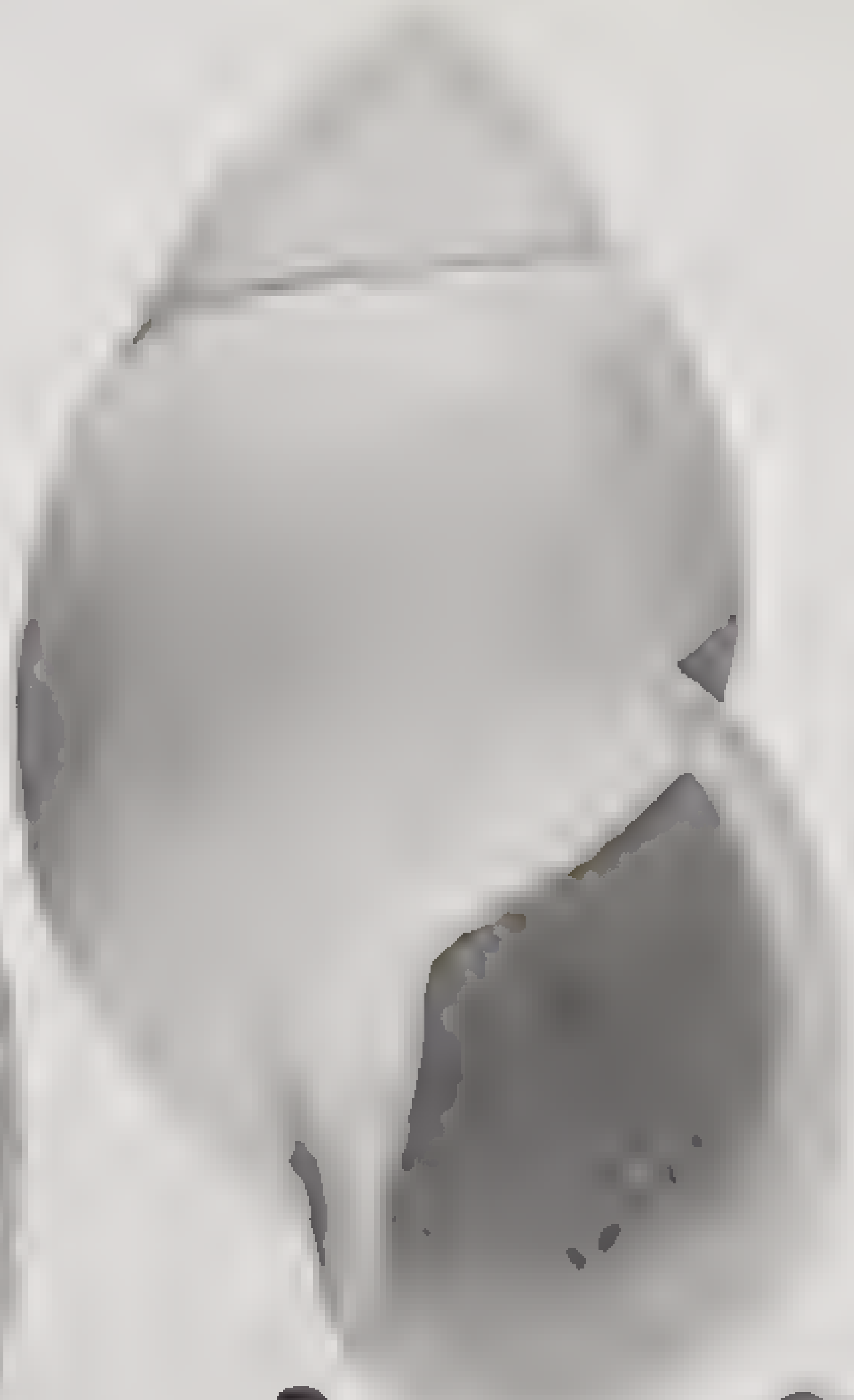

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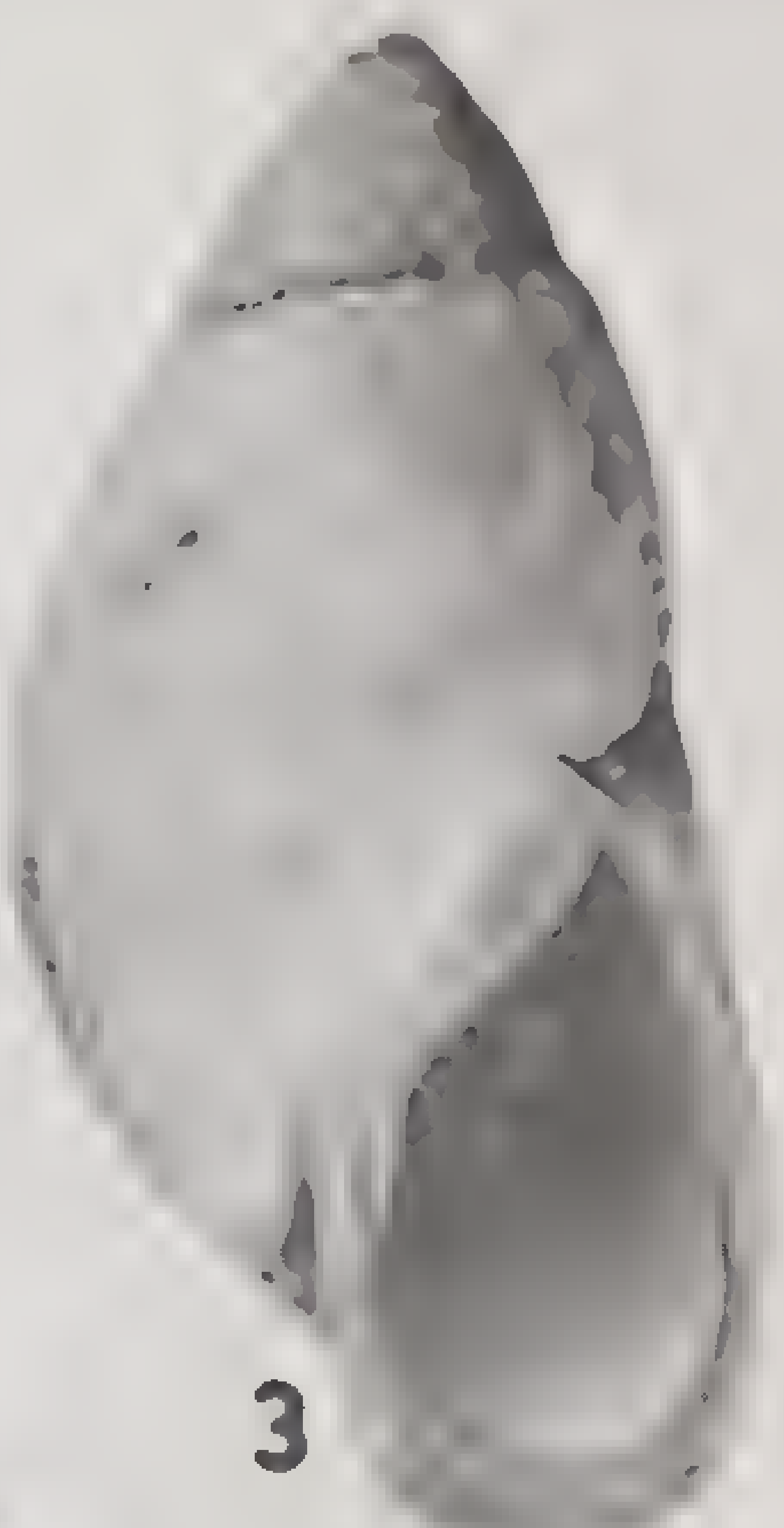

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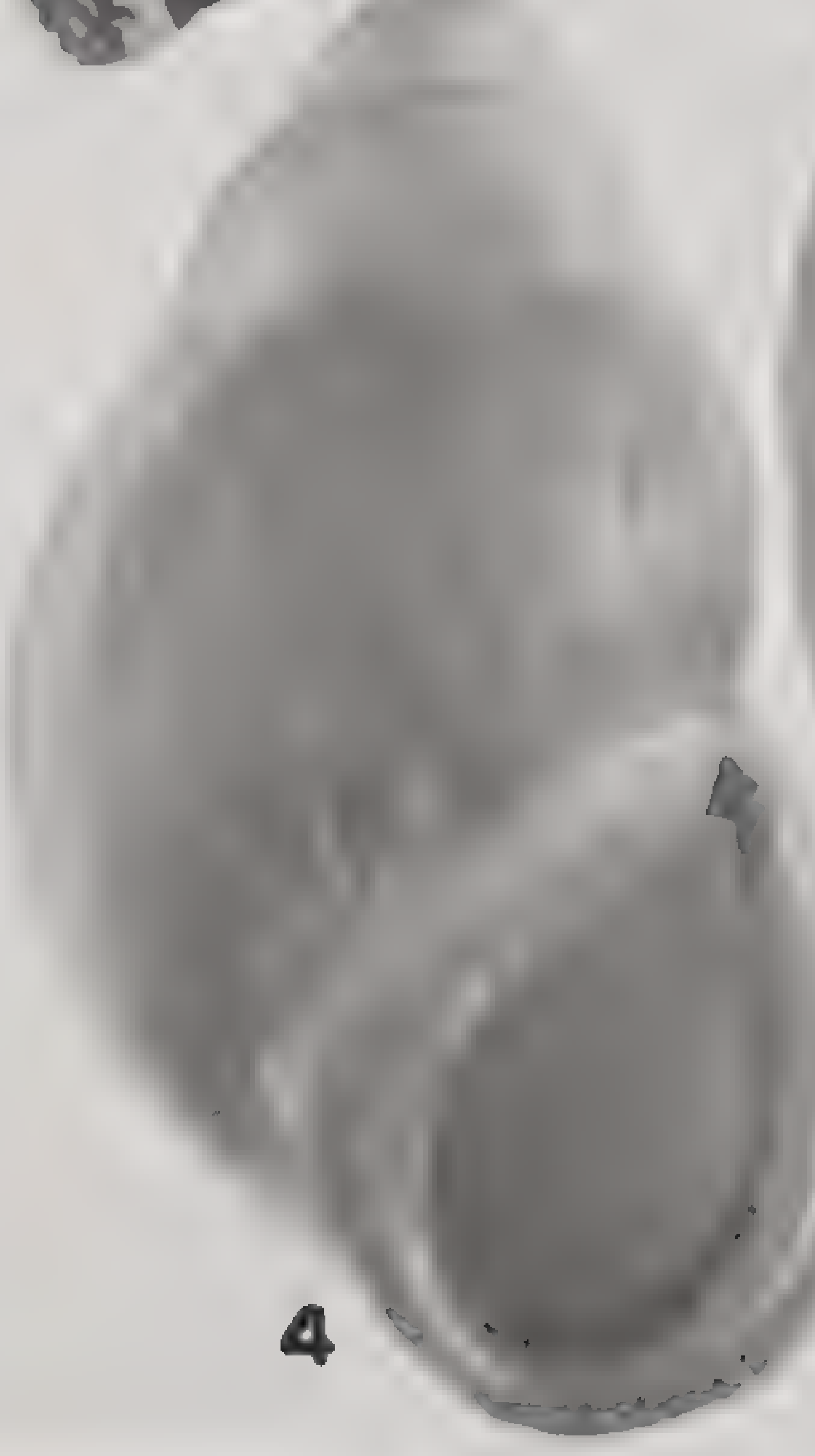

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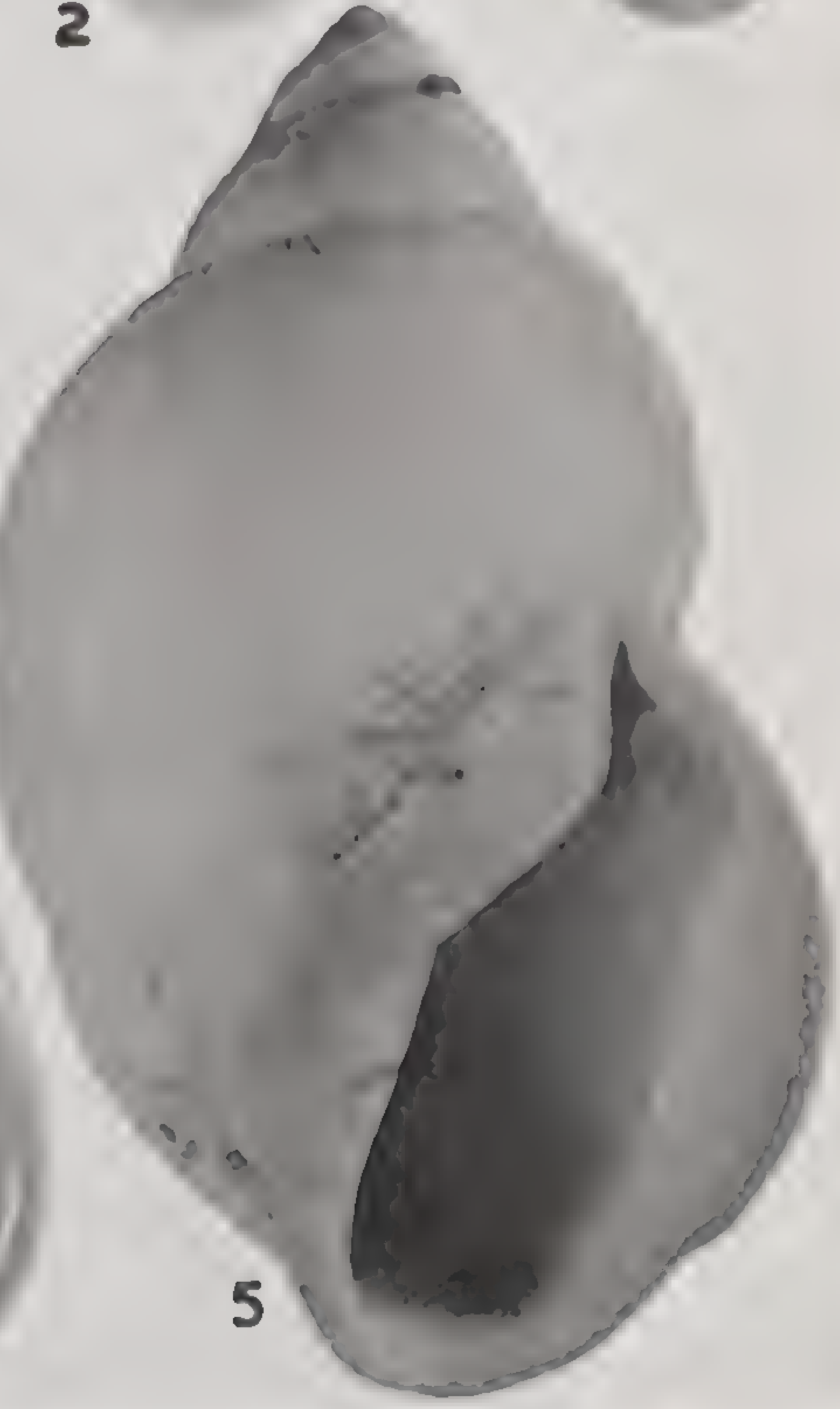

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PLATE 2

PLATE 2

Figs. 1 and 2. *Gonyostomus multicolor miersii* (Sowerby). Brazil. M.C.Z.

Fig. 3. *Strophocheilus oblongus* (O. F. Müller). Abnormal. Demerara. M.C.Z. 154014.

Fig. 4. *Strophocheilus oblongus elongatus* J. Bequaert. Holotype. Nueva Palmira. M.C.Z. 76538.

Fig. 5. *Strophocheilus oblongus* (O. F. Müller). Abnormal. Pará. M.C.Z. 58885.

Fig. 6. *Strophocheilus carrikeri* Pilsbry. Holotype. Huacapistana. Ac.N.S.-Phila. 151811.

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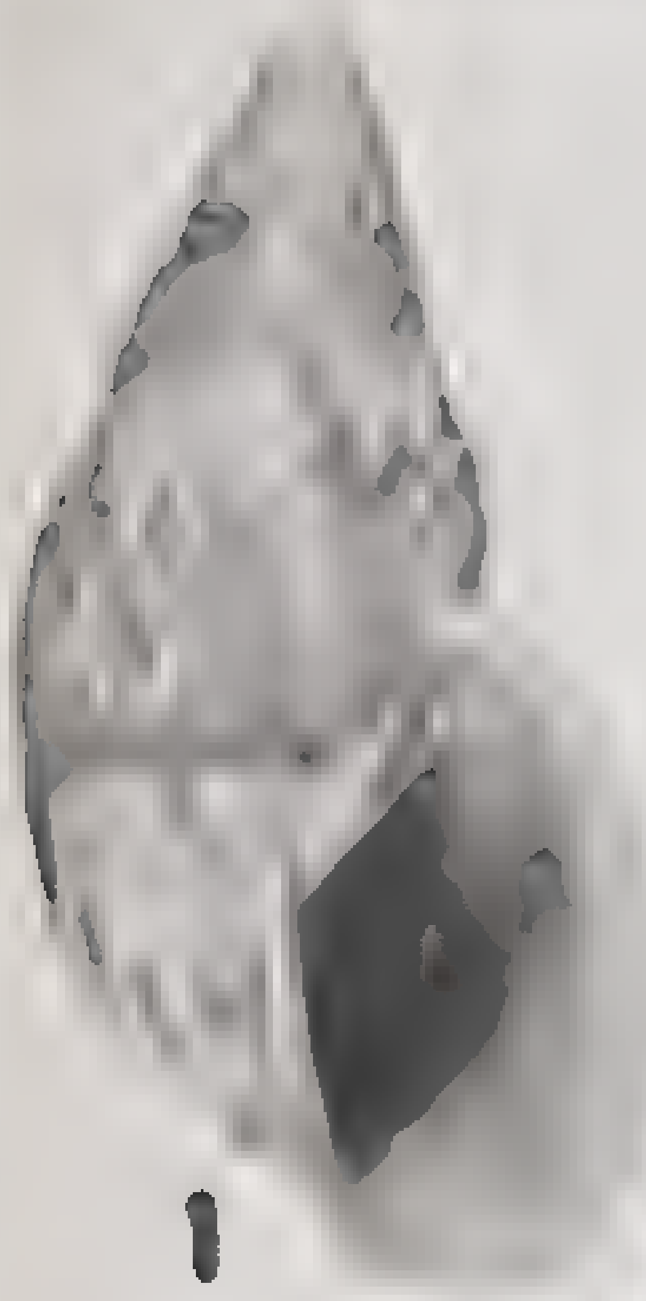

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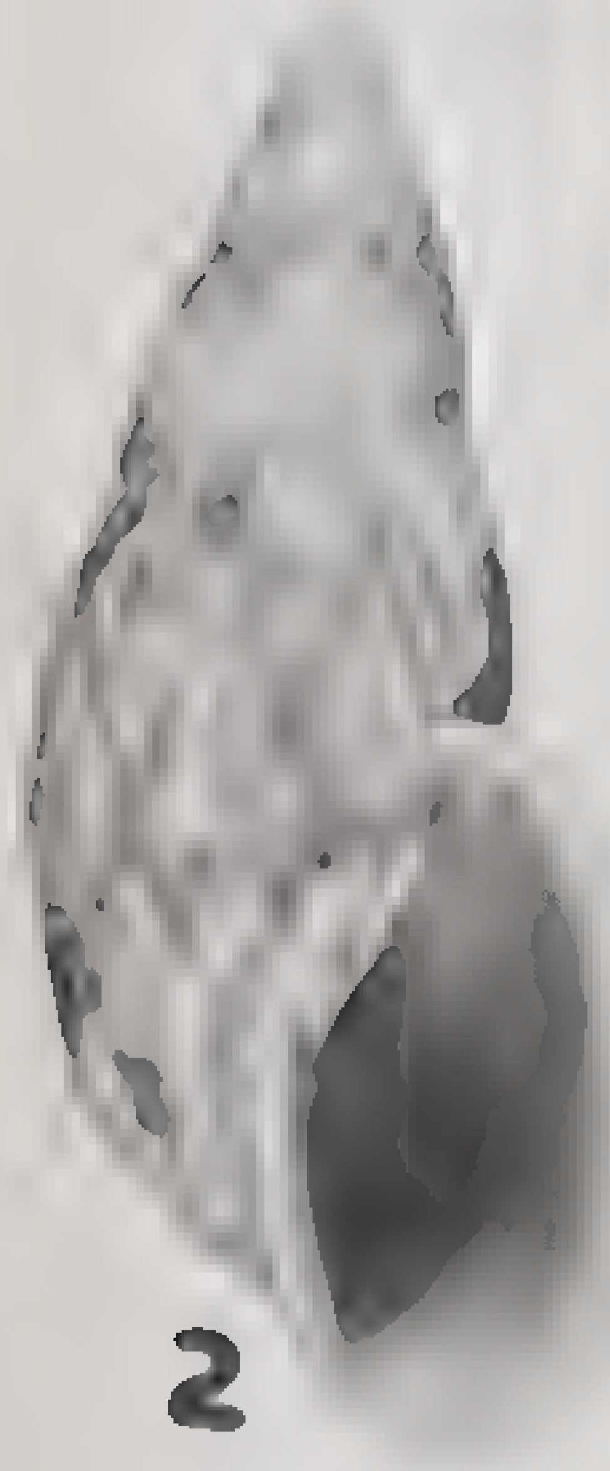

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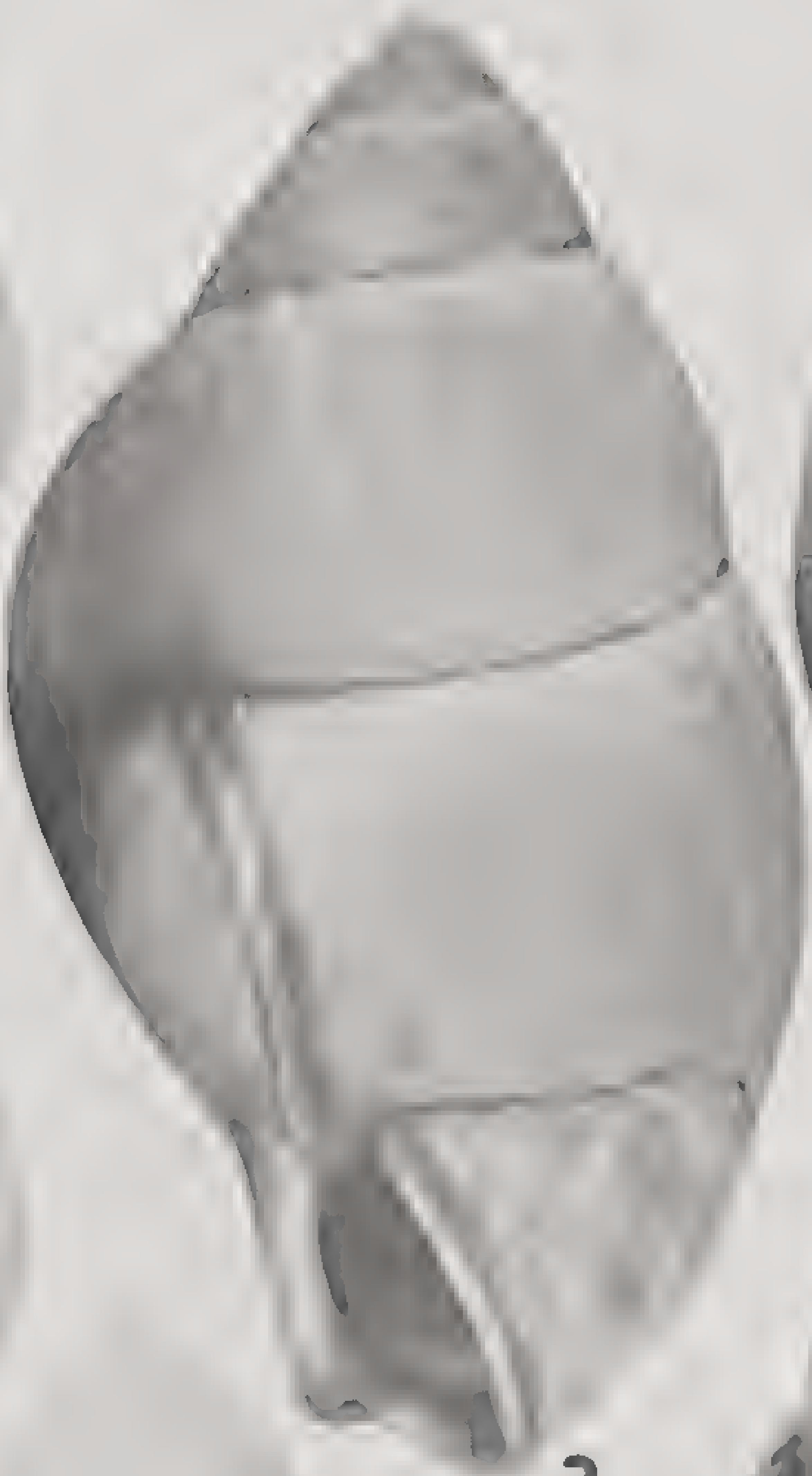

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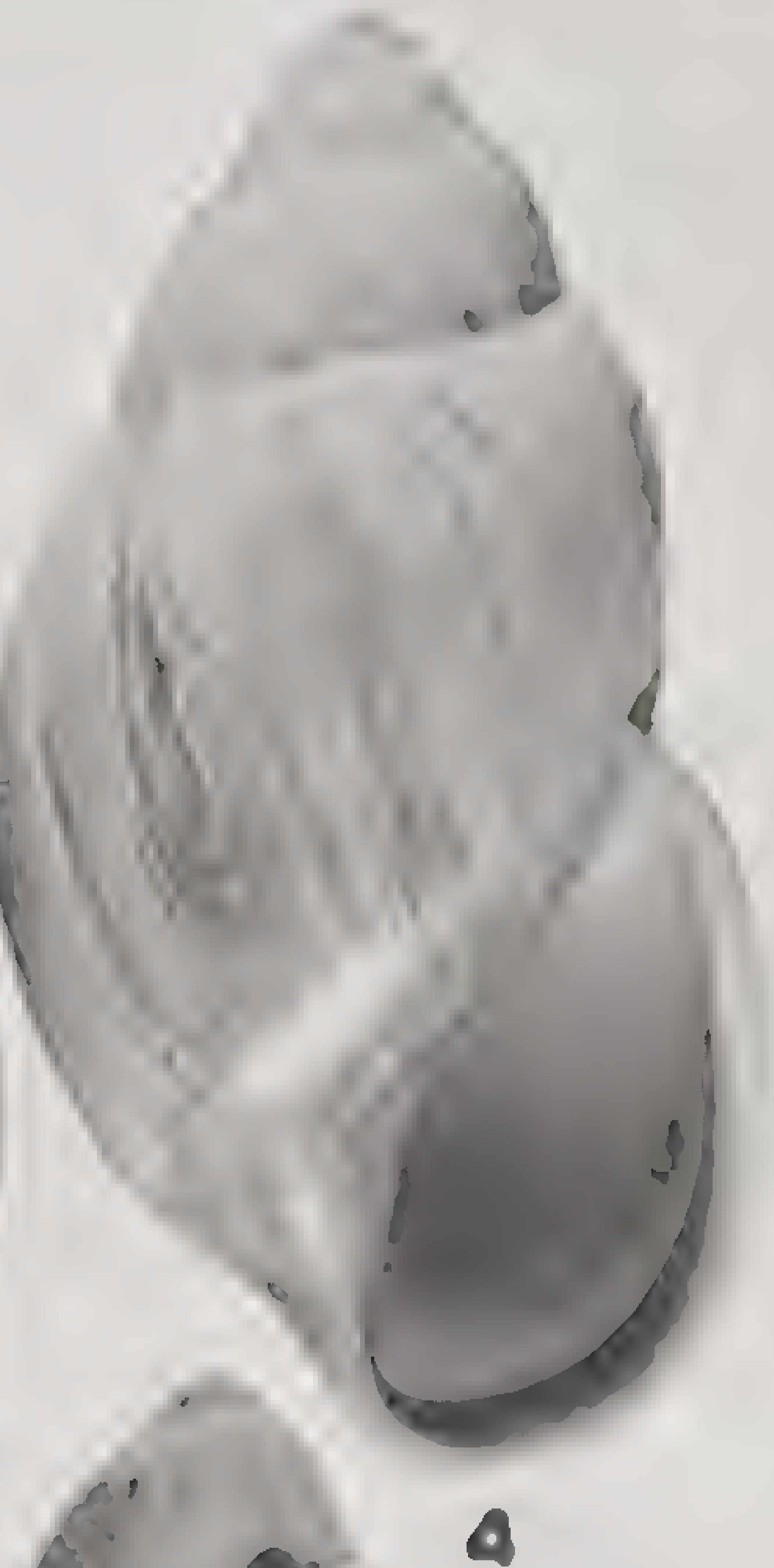

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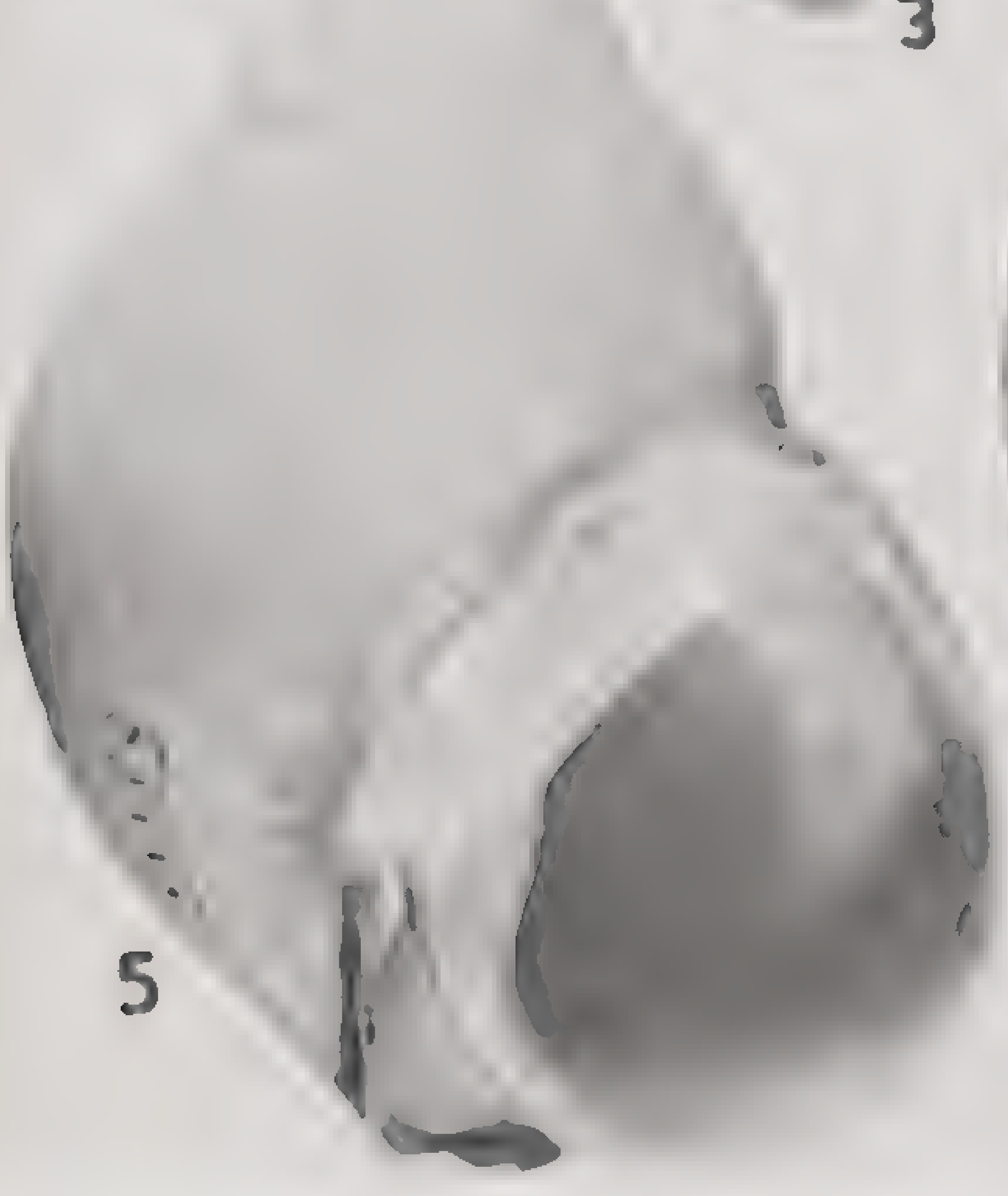

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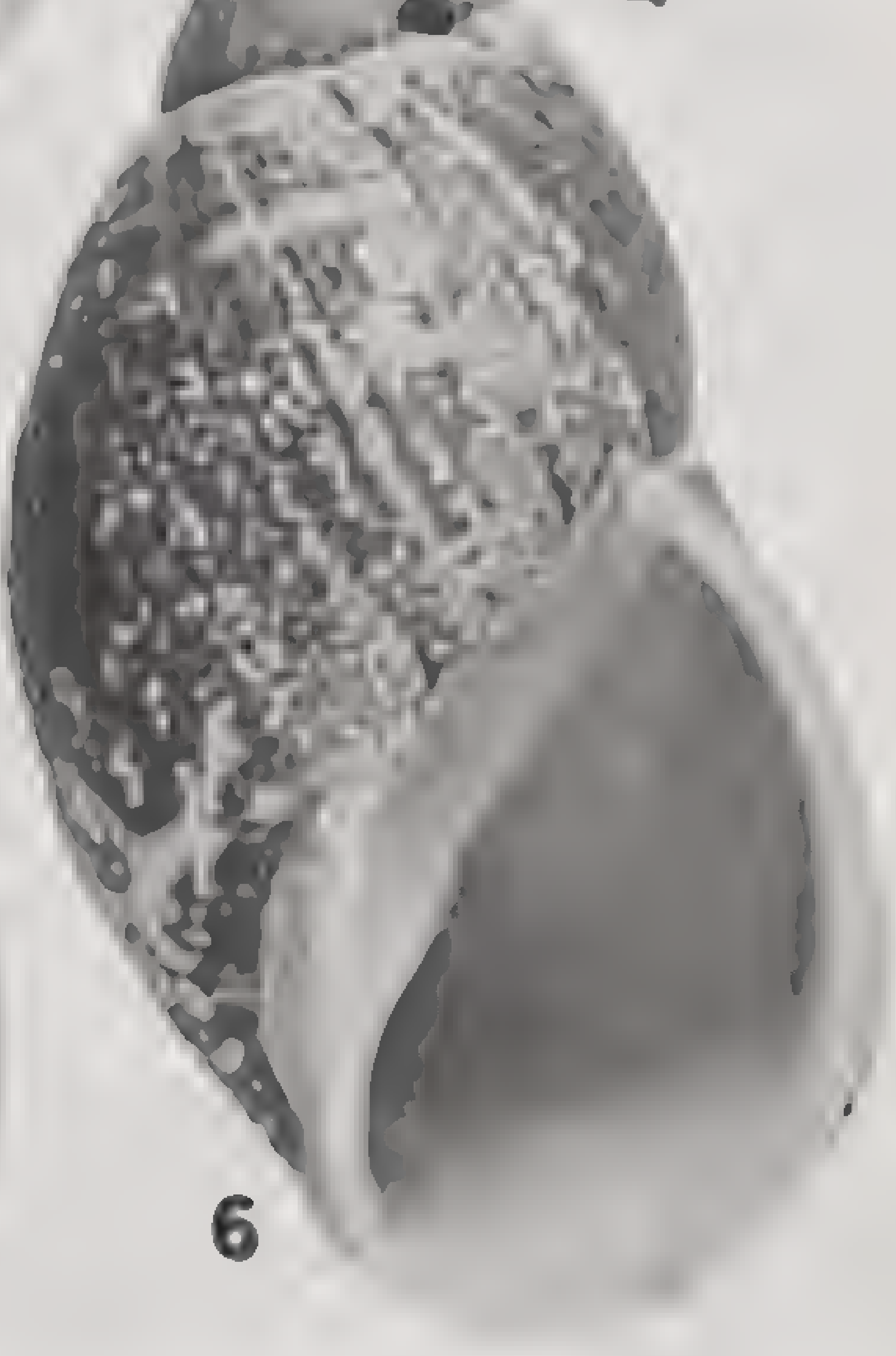

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PLATE 3

PLATE 3

Fig. 1. *Strophocheilus lichtensteini semimalleatus* Fulton. Chanchamayo. M.C.Z. 175334.

Fig. 2. *Gonyostomus egregius* (Pfeiffer). Serra do Rio Preto. M.C.Z. 74440.

Fig. 3. *Strophocheilus pudicus roseolabris* J. Bequaert. Holotype. Bahia. M.C.Z. 177681.

Fig. 4. *Strophocheilus separabilis* Fulton. Holotype of *S. jenksianus* Pilsbry. Huanuco. Ac.N.S.Phila. 175769.

Fig. 5. *Strophocheilus maximus* (Sowerby). Rurrenabaque. U.S.N.M. 361143.

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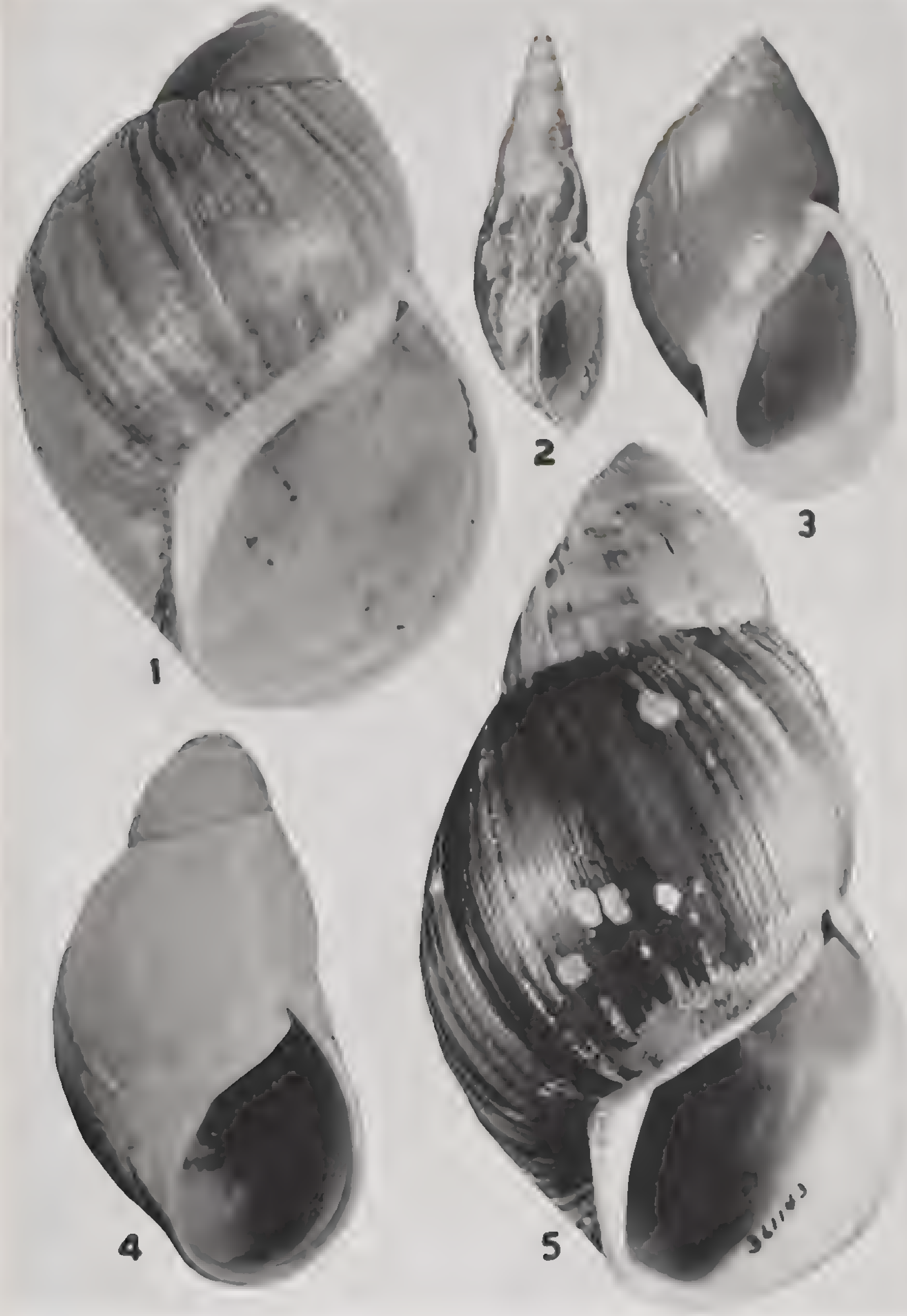
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PLATE 4

PLATE 4

Fig. 1. *Strophocheilus auritus* (Sowerby). Copy of original figure of type of *S. versatilis* Fulton.

Fig. 2. *Strophocheilus lichtensteini semimalleatus* Fulton. Copy of original figure of type.

Fig. 3. *Strophocheilus pilsbryi* v. Ihering. Paratype. Piquete. M.C.Z. 179236.

Fig. 4. *Strophocheilus pudicus* (O. F. Müller). Bahia. M.C.Z. 31382. Summit of young shell, X 5.

Fig. 5. *Gonyostomus multicolor* (Rang). Brazil. M.C.Z.

Fig. 6. *Gonyostomus turnix* (Gould). Brazil. M.C.Z. Summit of adult shell, X 5.

Fig. 7. *Strophocheilus globosus* (v. Martens). Salto. M.C.Z. 76539. Summit of nearly adult shell, X 5.

Natural Size, except Figs. 4, 6 and 7.

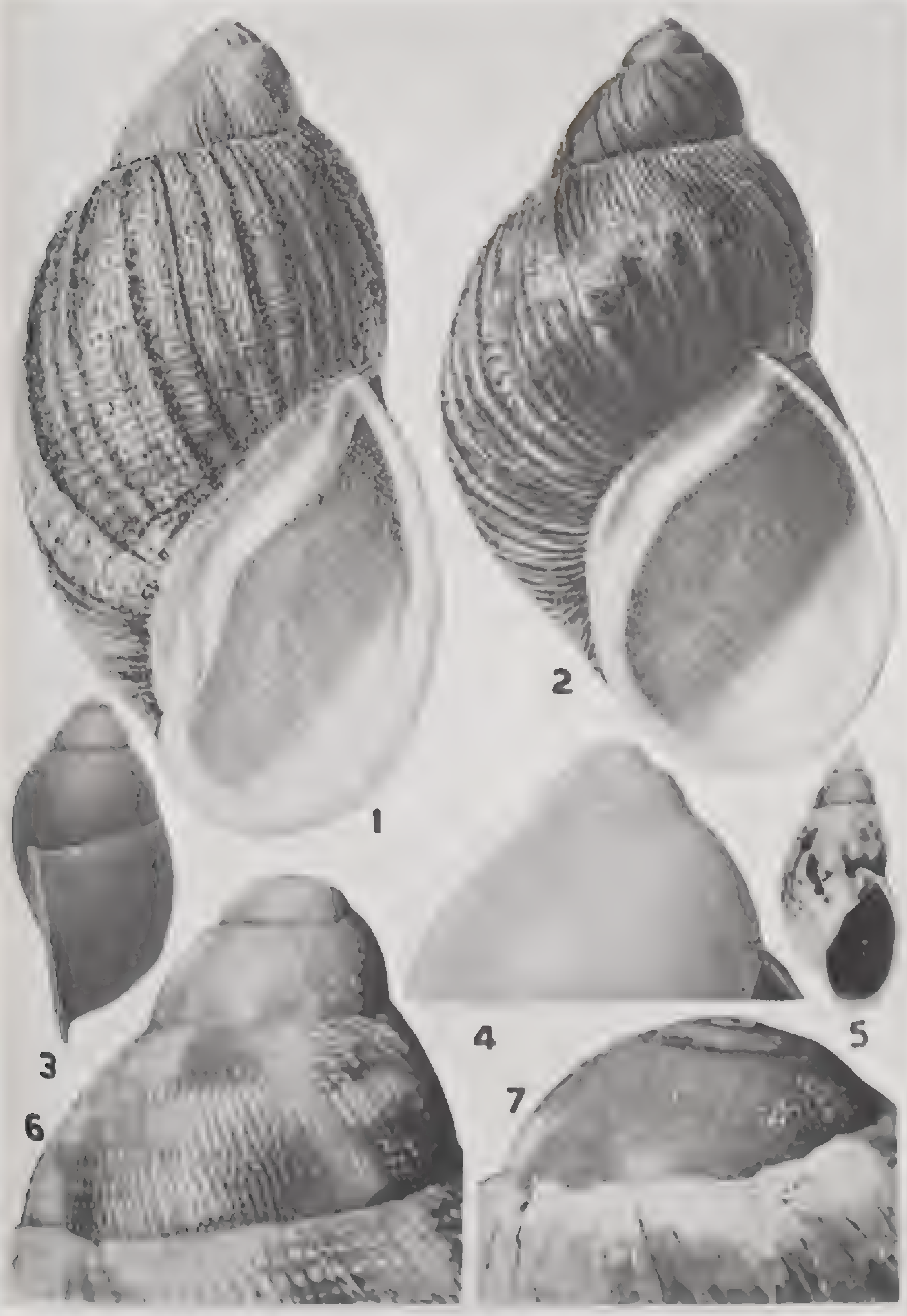
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PLATE 5

PLATE 5

Fig. 1. *Strophocheilus terrestris oosomus* Pilsbry. Holotype. Brazil. Ac.N.S.-Phila. 32810.

Fig. 2. *Strophocheilus terrestris oliveirai* J. Bequaert. Holotype. Propriá. M.C.Z. 175321.

Fig. 3. *Strophocheilus bronni* (Pfeiffer). Copy of Mawe's figure of "*Helix ovalis*, var." (1812).

Fig. 4. *Strophocheilus granulosus paranaguensis* Pilsbry and v. Ihering. Holotype. Paranaguá. Ac.N.S.Phila. 72646.

All Natural Size.

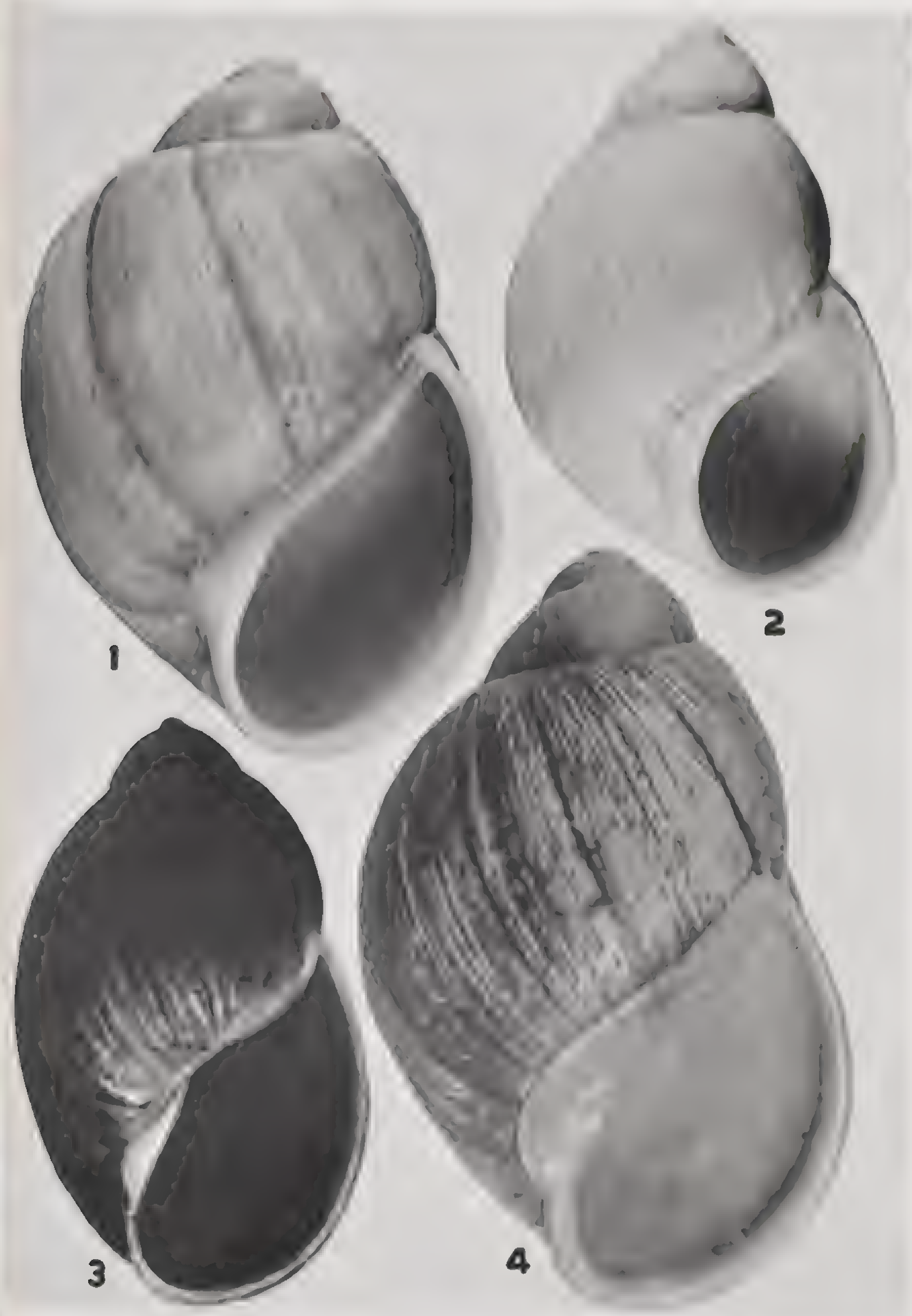
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PLATE 6

PLATE 6

Fig. 1. *Strophocheilus oblongus conicus* J. Bequaert. Varzea do Sal. Top portion of shell. U.S.N.M.

Fig. 2. *Strophocheilus oblongus haemastomus* (Scopoli). U.S.N.M. 334537.

Fig. 3. *Strophocheilus unidentatus* (Sowerby). Est. Santa Catharina. U.S.N.M. 522340.

Fig. 4. *Strophocheilus carrikeri* Pilsbry. Chilpes. M.C.Z. 96952.

Fig. 5. *Strophocheilus ovatus grandis* (v. Martens). Ilha São Sebastião. M.U.Mich. 36281.

Fig. 6. *Strophocheilus pilsbryi* v. Ihering. Holotype. Piquete. Ac.N.S.-Phila. 171230.

Fig. 7. *Strophocheilus lutescens* (King and Broderip). Cerro Largo. U.S.-N.M. 341377.

All Natural Size.

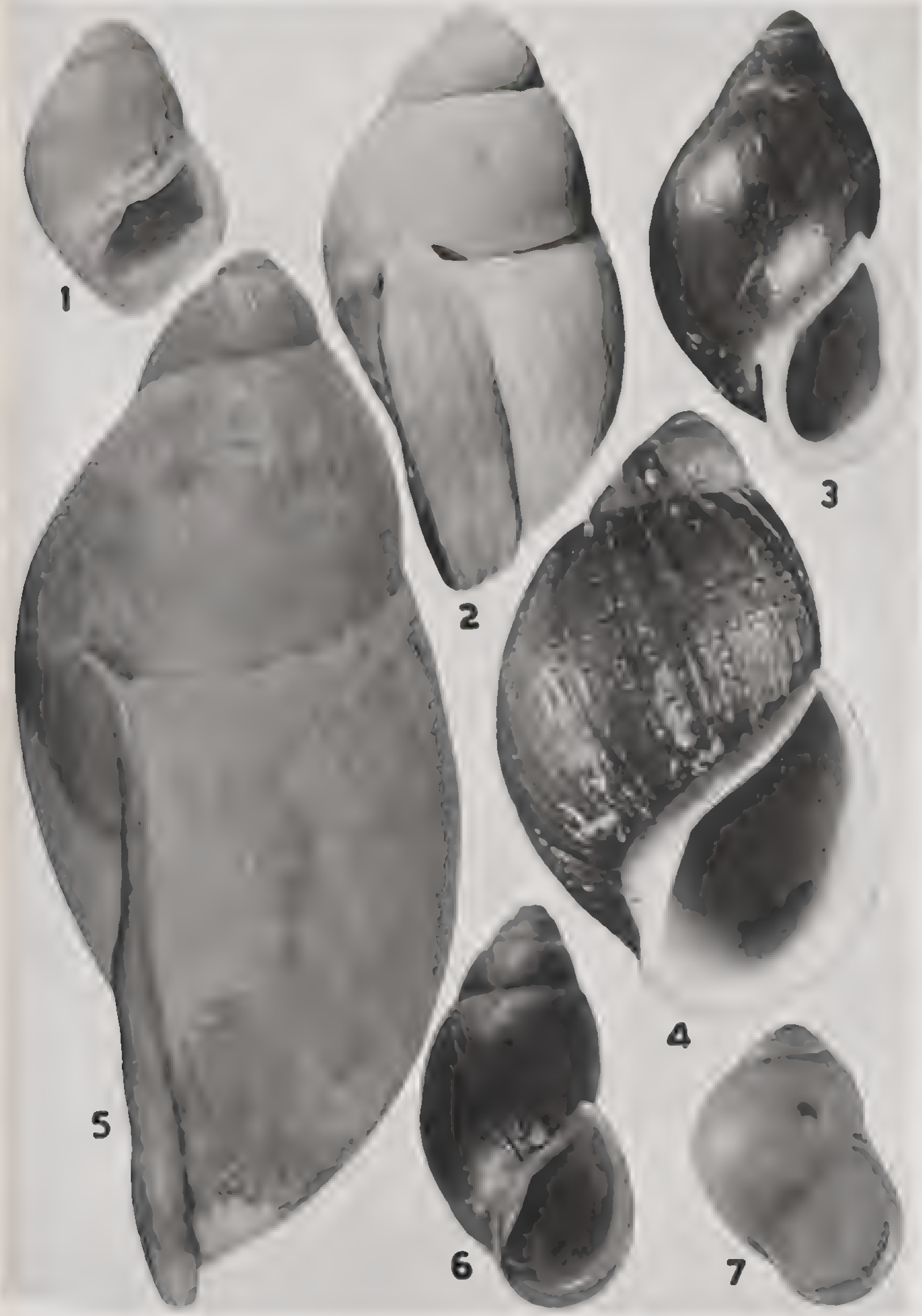
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PLATE 7

PLATE 7

Fig. 1. *Strophocheilus milleri kronei* v. Ihering. Topotype. Rio Grande. Ac.N.S.Phila. 109062.

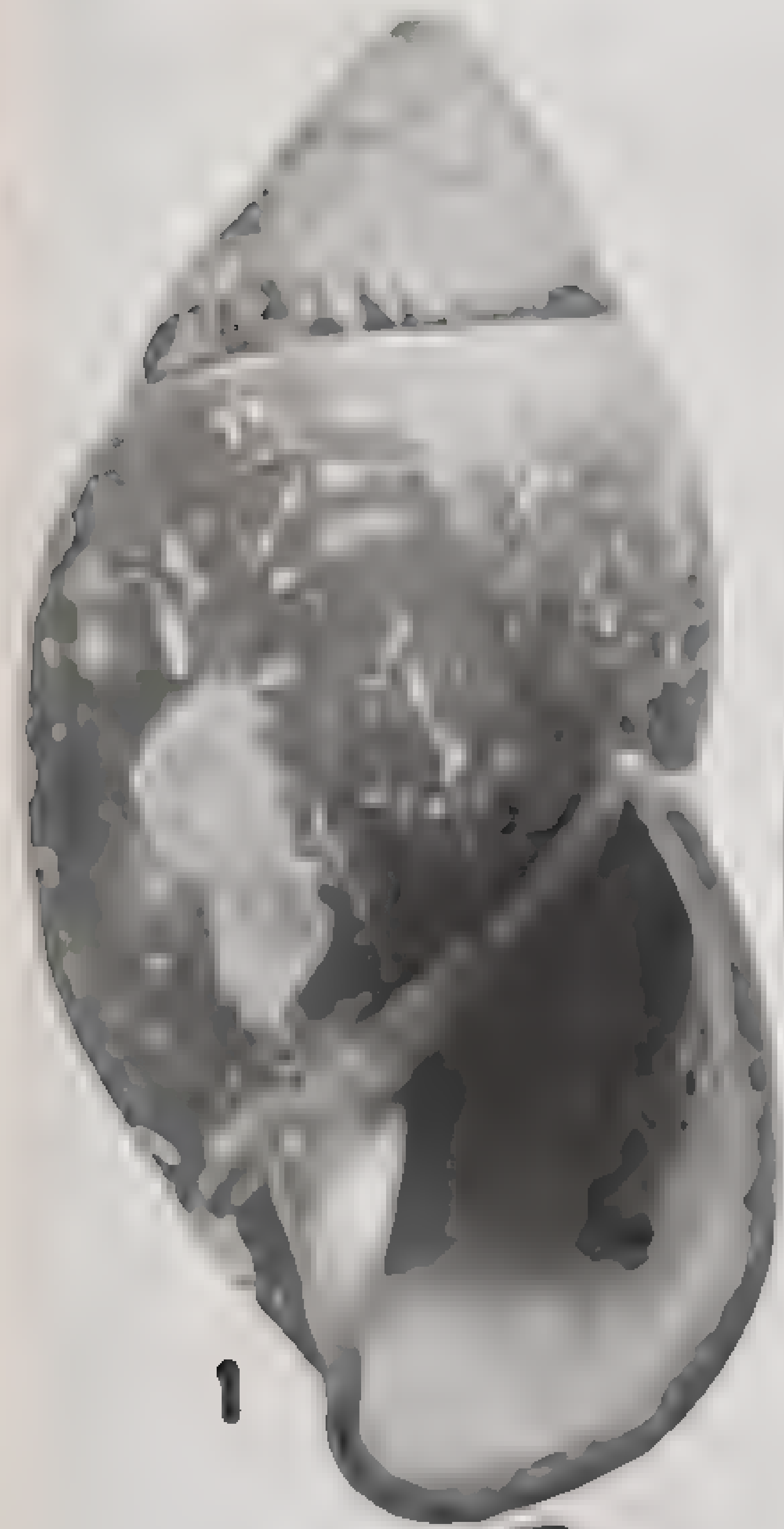
Fig. 2. *Strophocheilus leucostoma* (Sowerby). Vilcanota. U.S.N.M. 522342.

Fig. 3. *Strophocheilus carrikeri* Pilsbry. Topotype. Huacapistana. M.C.Z. 139824.

Fig. 4. *Strophocheilus ovatus* (O. F. Müller). Copy of Mawe's figure of "*Helix ovalis*" (1812).

Fig. 5. *Strophocheilus terrestris* (Spix). Abnormal, umbilicate. Brazil. M.C.Z.

All Natural Size.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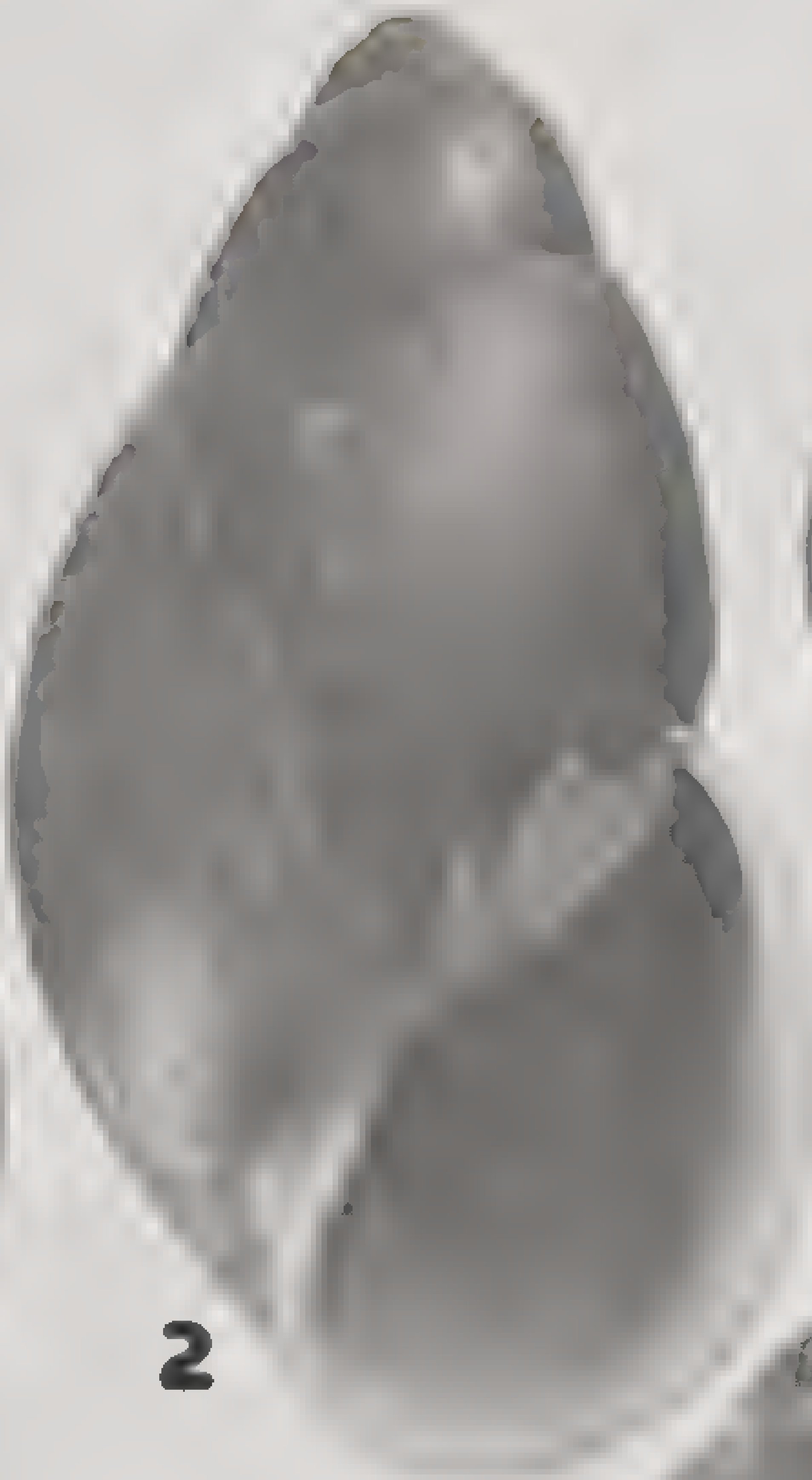
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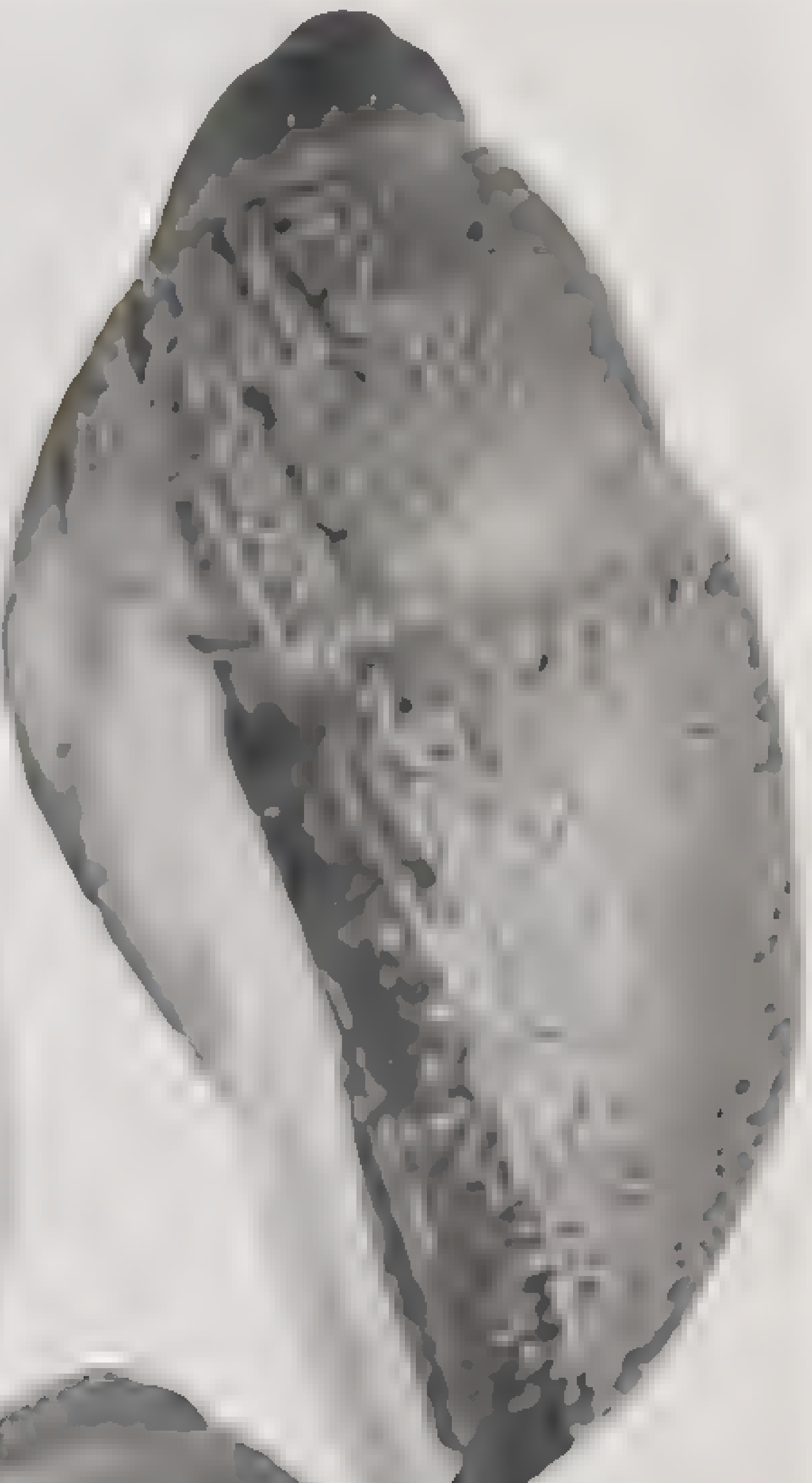
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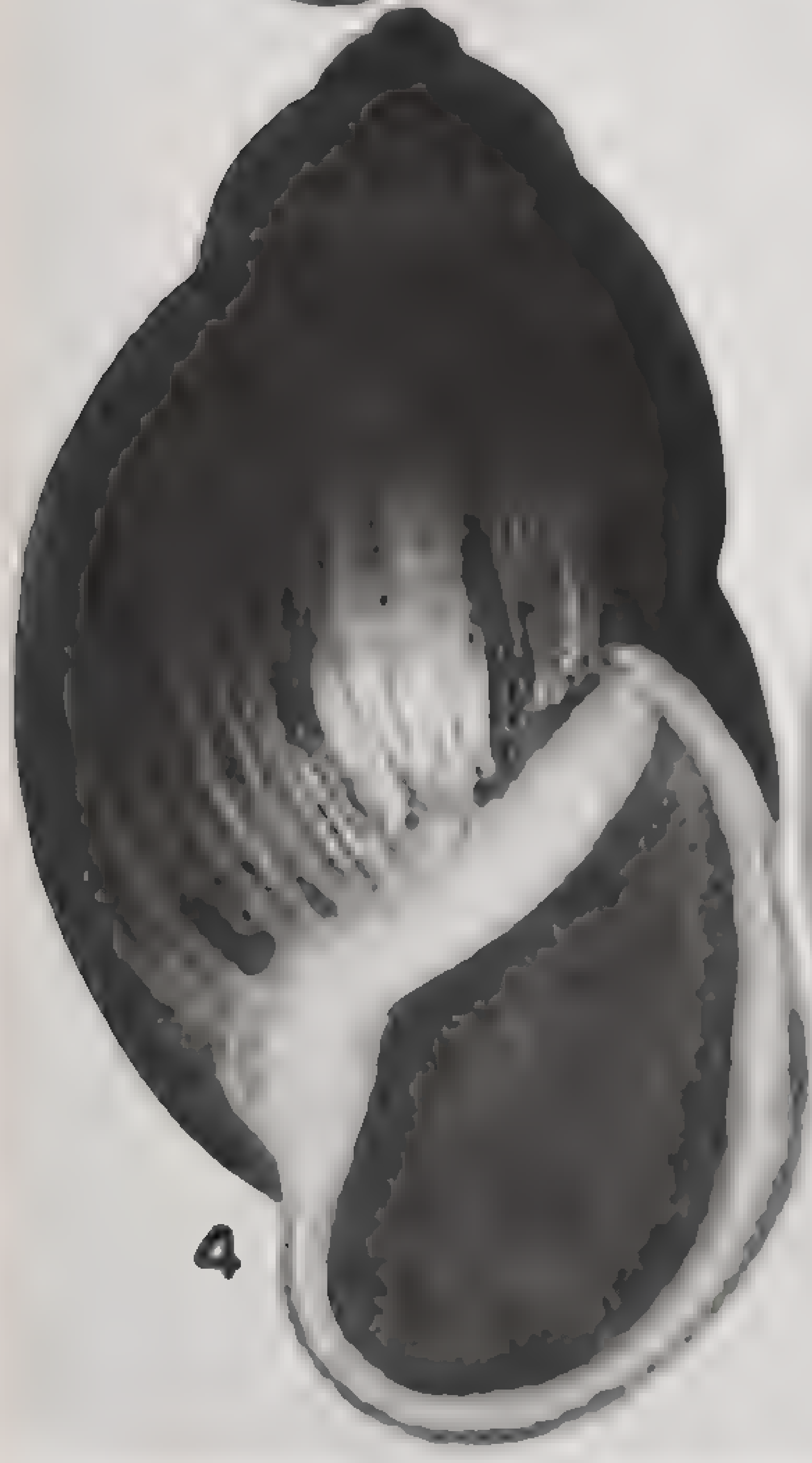
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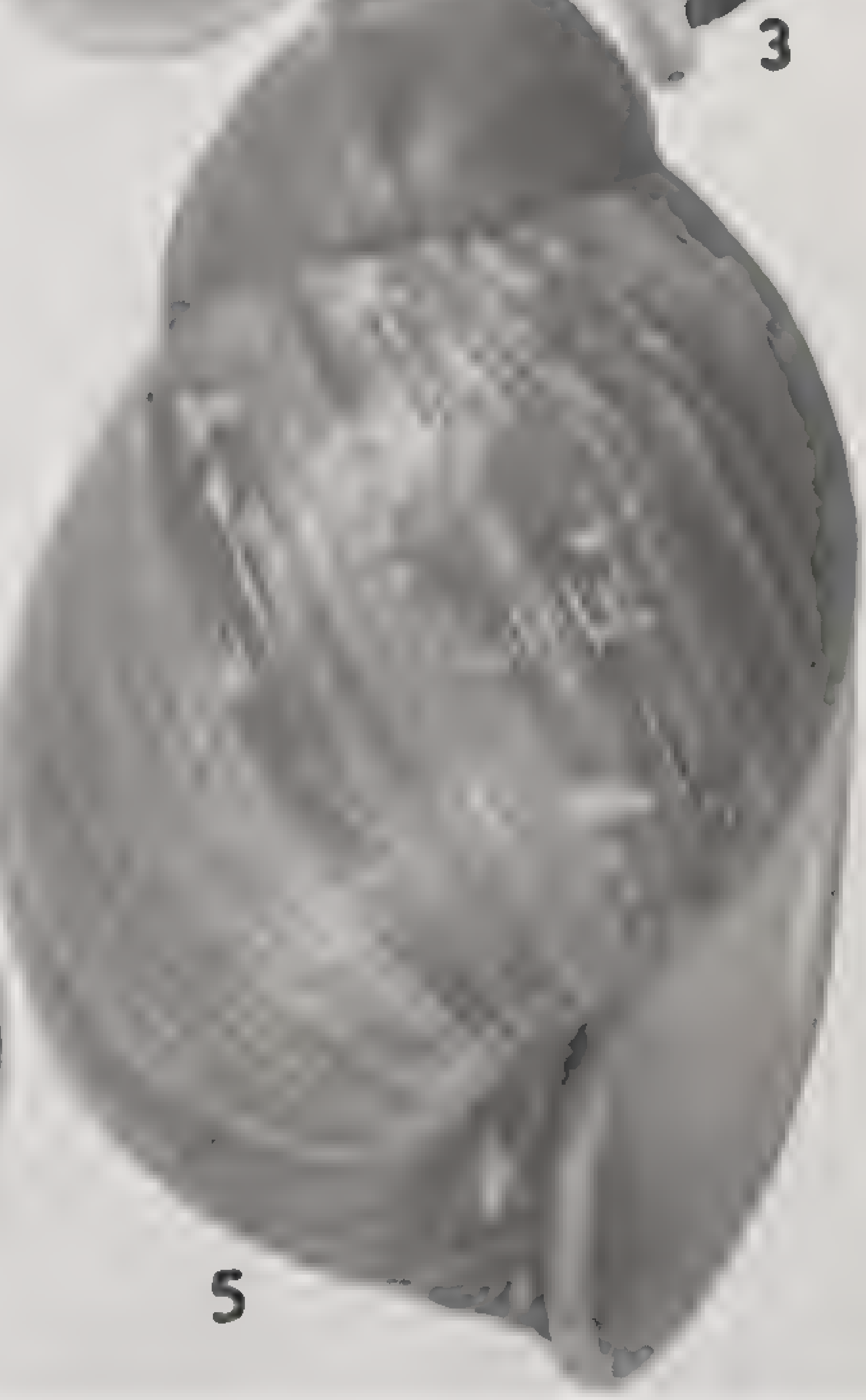
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PLATE 8

PLATE 8

Fig. 1. *Strophocheilus contortuplicatus* (Reeve). Copy of original figure of type.

Figs. 2 and 4. *Strophocheilus pachychilus* (Pfeiffer). Chile. U.S.N.M. 307495.

Fig. 3. *Strophocheilus atavus* J. Bequaert. Holotype. Miguez. U.S.N.M. 383007.

Fig. 5. *Strophocheilus pudicus* (O. F. Müller). Brazil. M.C.Z.

Fig. 6. *Strophocheilus ovatus chionostoma* (Mörch). Brazil. M.C.Z. 39254.

All Natural Size.

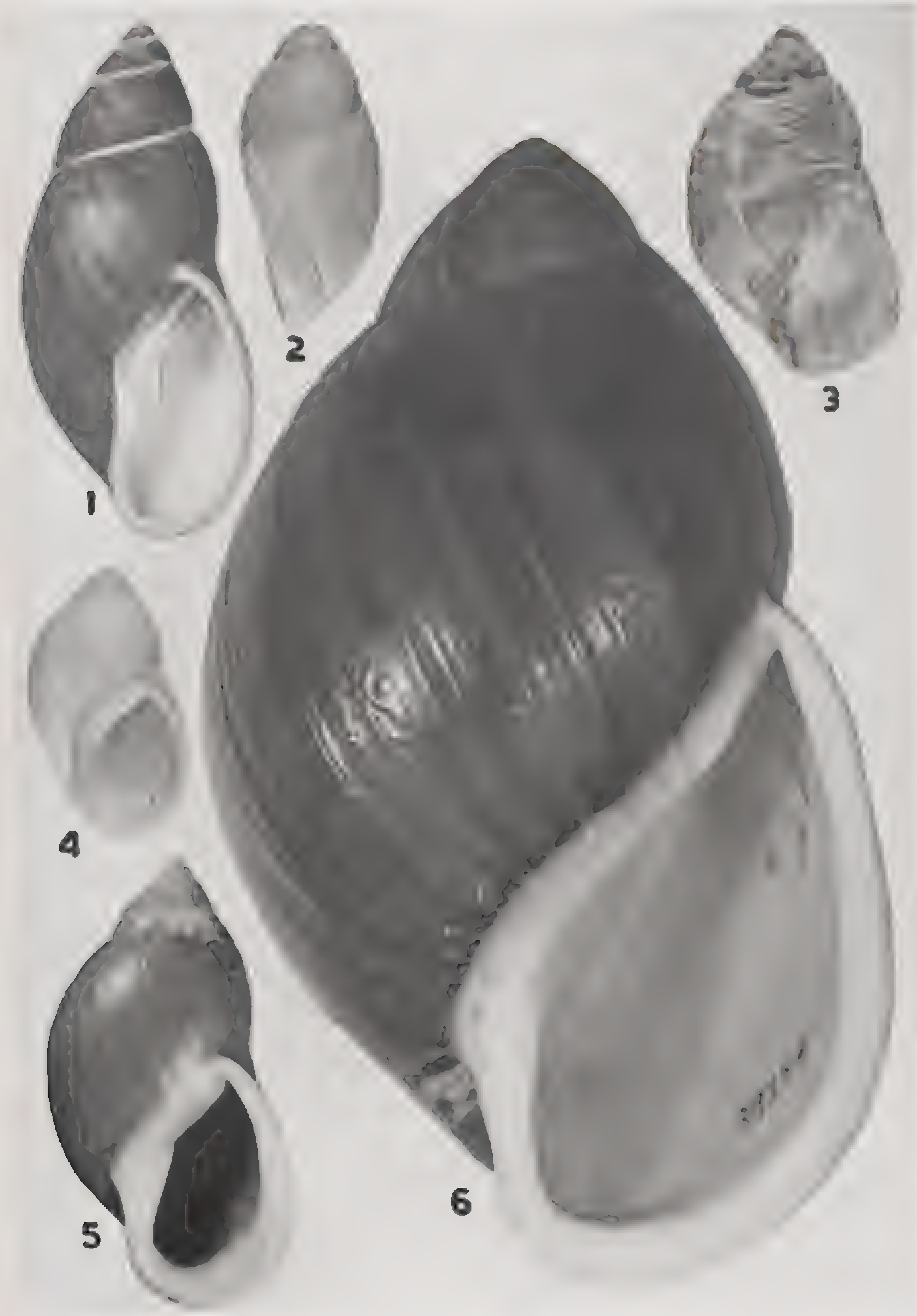
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PLATE 9

PLATE 9

Fig. 1. *Strophocheilus separabilis* Fulton. Copy of original reduced figure of type.

Fig. 2. *Strophocheilus planidens fusoides* J. Bequaert. Holotype. Taquara do Mundo Novo. M.C.Z. 75314.

Figs. 3 and 7. *Gonyostomus multicolor* (Rang). Corcovado. M.C.Z. 74441.

Fig. 4. *Strophocheilus pudicus* (O. F. Müller). Bahia. M.C.Z. 31382.

Fig. 5. *Strophocheilus erythrosoma* Pilsbry. Holotype. Brazil. Ac.N.S.-Phila. 30341.

Fig. 6. *Strophocheilus unidentatus* (Sowerby). Brazil. U.S.N.M. 122307.

Fig. 8. *Strophocheilus ovatus grandis* (v. Martens). Ilha São Sebastião. M.U.Mich. 36281.

Natural Size, except Fig. 1.

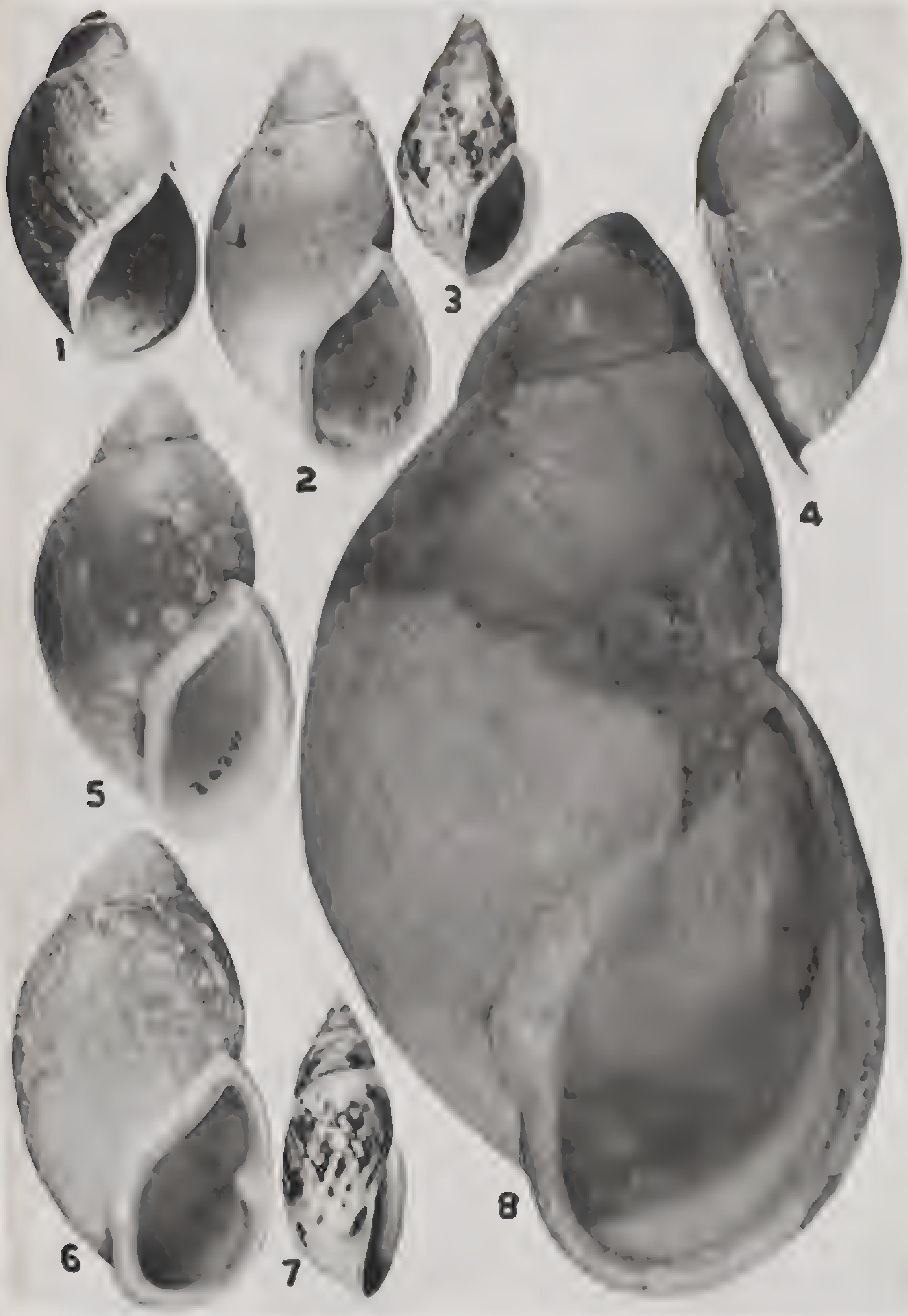
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PLATE 10

PLATE 10

Fig. 1. *Strophocheilus leucostoma* (Sowerby). Ambo. M.C.Z. 139495.

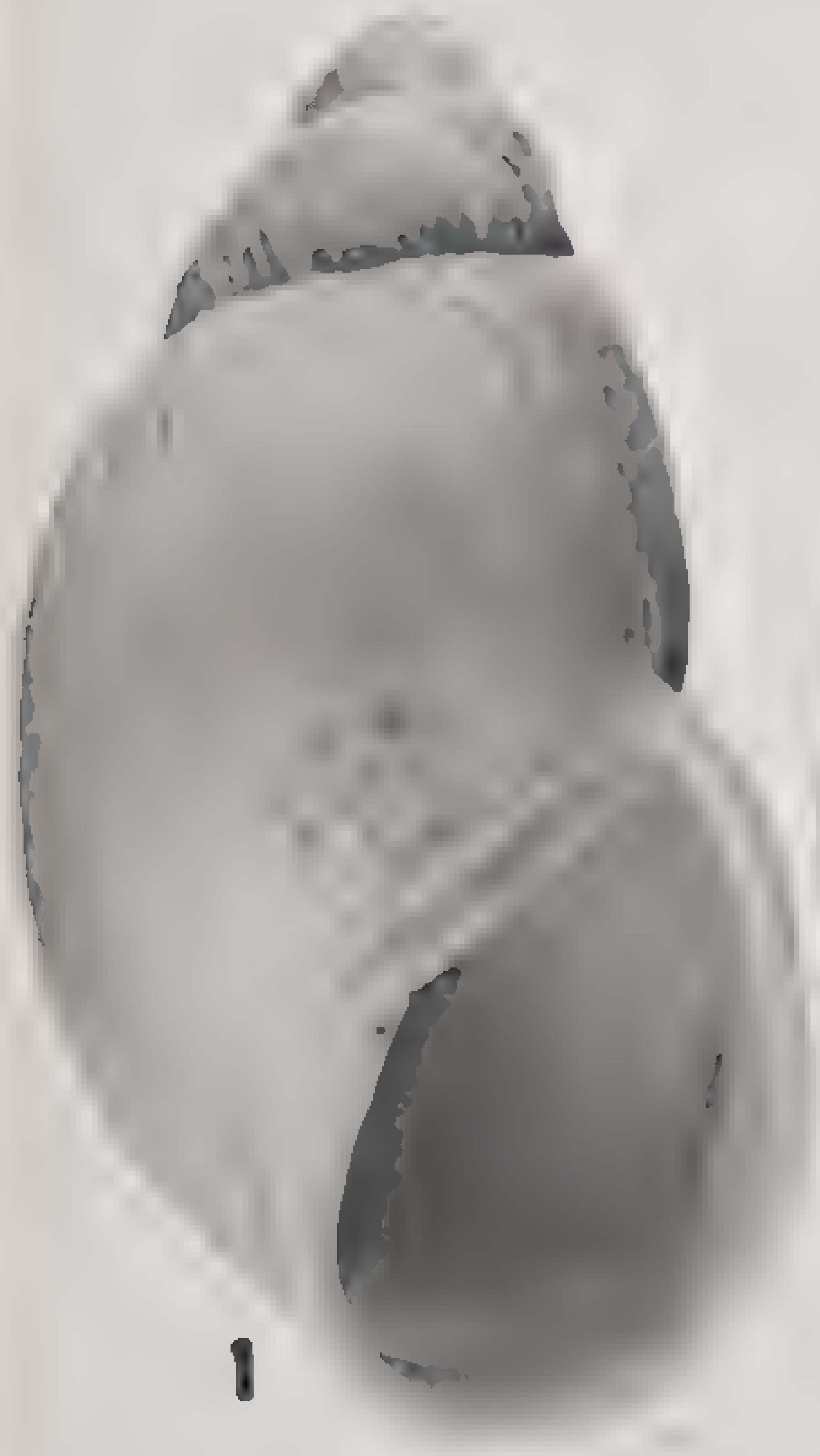
Fig. 2. *Strophocheilus leucostoma* (Sowerby). Peru. M.U.Mich. 144483.

Fig. 3. *Strophocheilus rosaceus* (King and Broderip). Paratype of *S. rosaceus* var. *particeps* Fulton. Chile. U.S.N.M. 466740.

Fig. 4. *Strophocheilus lichtensteini* (Albers). Bellavista. M.C.Z. 31628.

Fig. 5. *Strophocheilus oblongus albus* (Bland and Binney). Holotype. Tobago. M.C.Z. 90360.

All Natural Size.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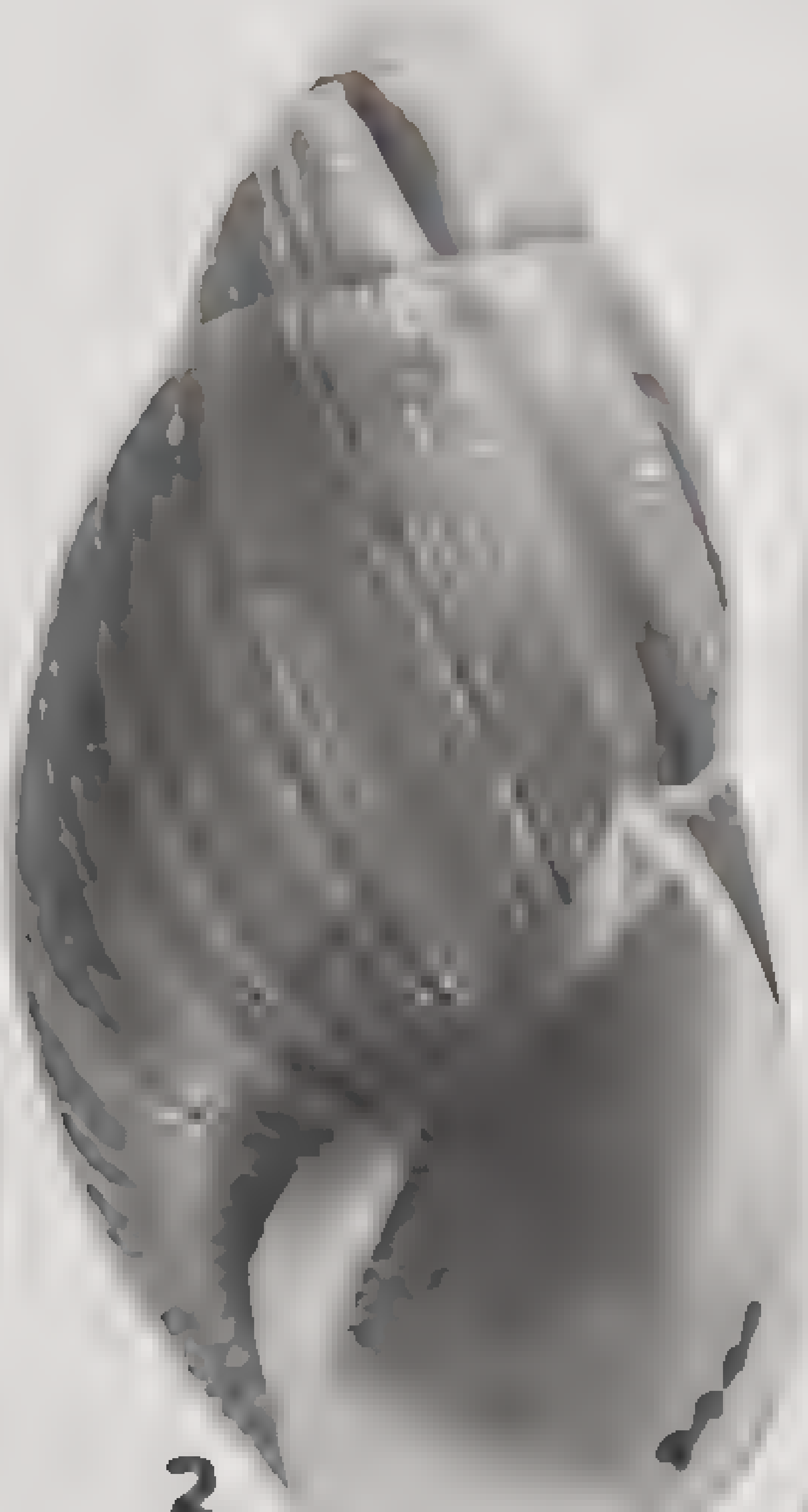
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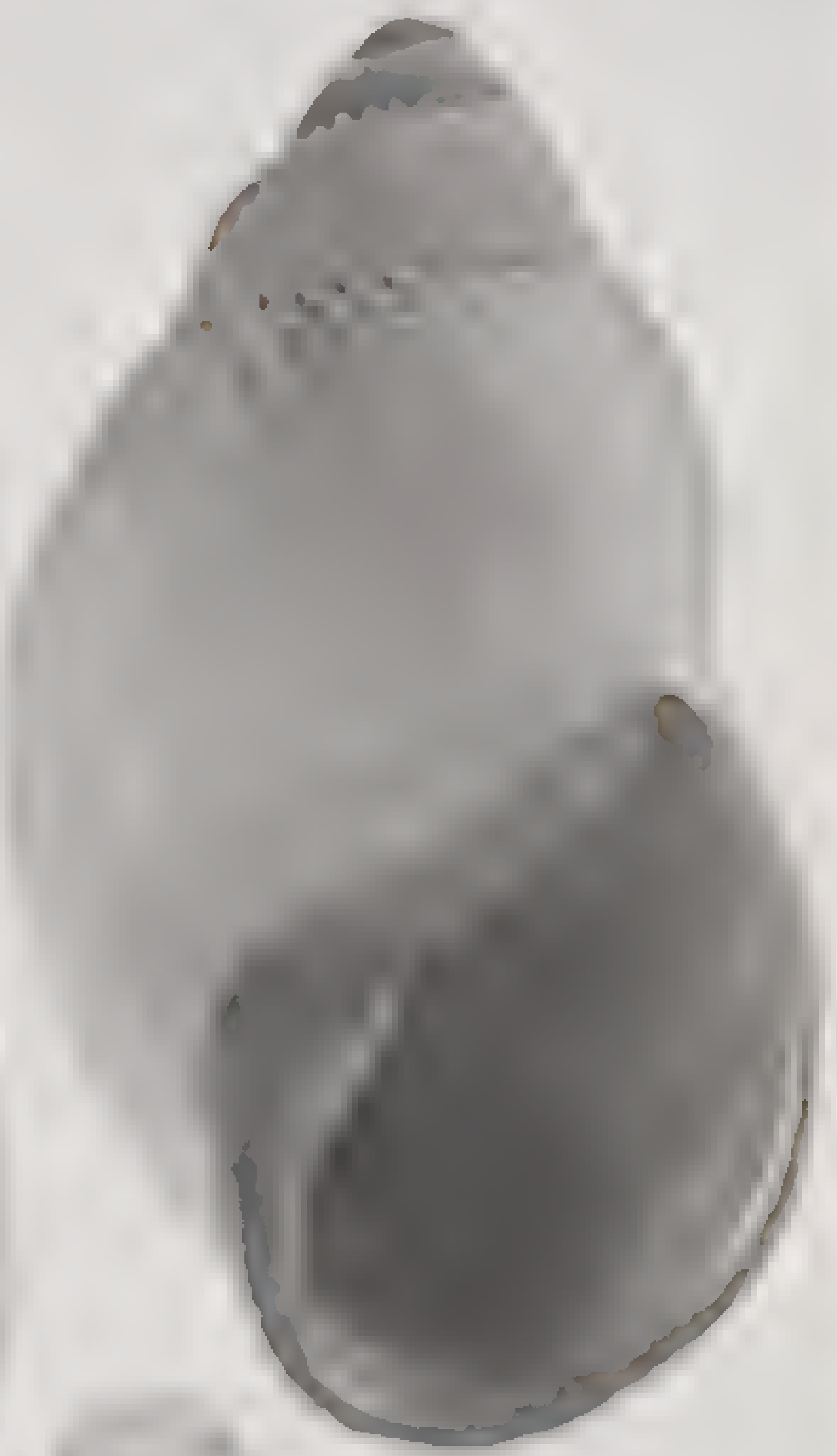
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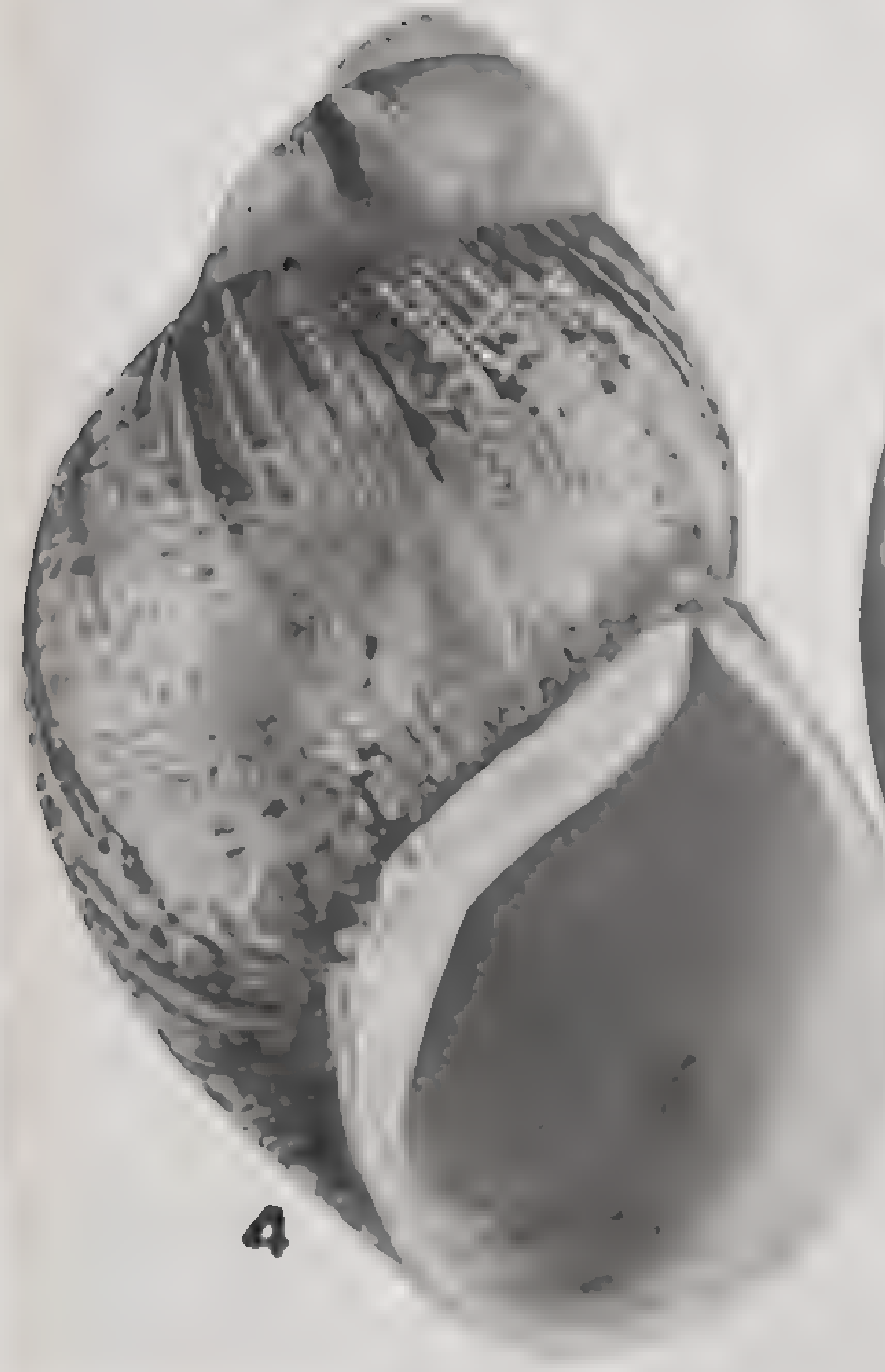
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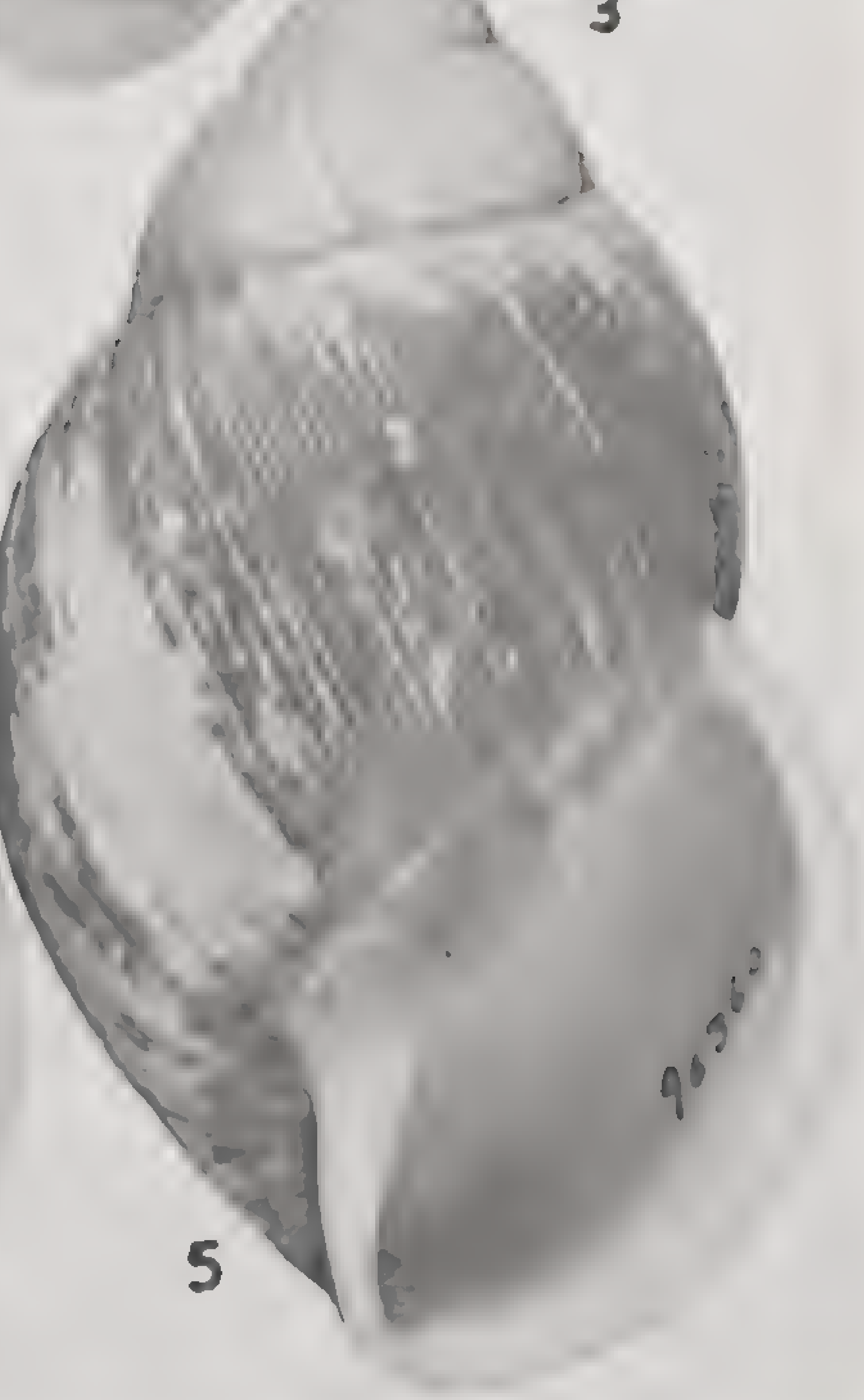

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PLATE 11

PLATE 11

Figs. 1, 2 and 3. *Strophocheilus chilensis* (Sowerby). Topotypes. Coquimbo. M.C.Z. 156682.

Fig. 4. *Gonyostomus egrègius* (Pfeiffer). Copy of Mawe's figure 4 (1812).

Fig. 5. *Strophocheilus popelairianus* (Nyst). San José de Mote. M.C.Z. 113844.

All Natural Size.

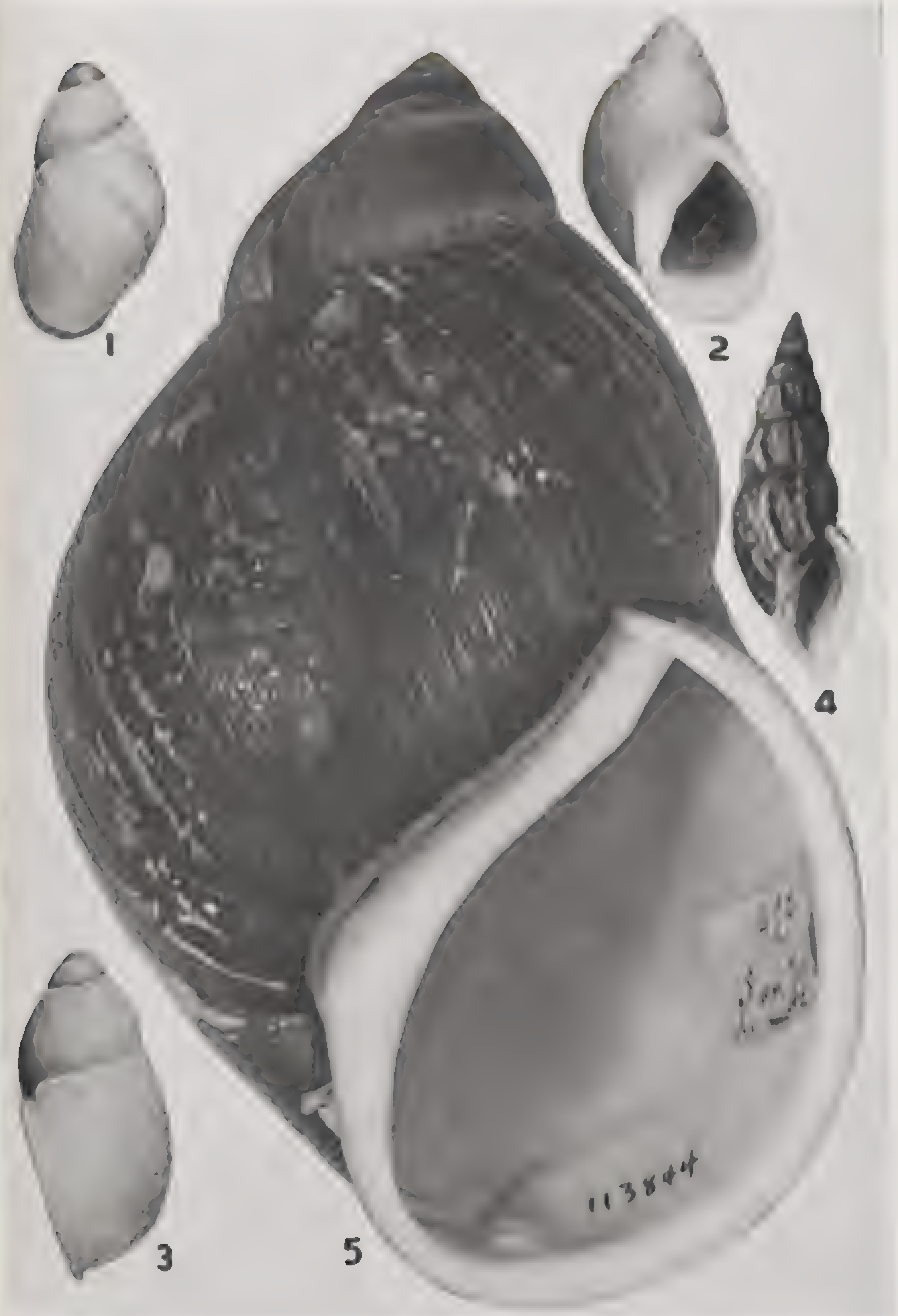
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PLATE 12

PLATE 12

Fig. 1. *Strophocheilus planidens* (Michelin). Brazil. M.C.Z.

Fig. 2. *Strophocheilus planidens fusoides* J. Bequaert. Paratype. Taquara do Mundo Novo. U.S.N.M. 122306.

Fig. 3. *Strophocheilus leucostoma* (Sowerby). San Miguel. U.S.N.M. 347839.

Fig. 4. *Strophocheilus d'orbignyi* (Döring). Villarino. M.C.Z. 132302.

Fig. 5. *Strophocheilus granulosus* (Rang). Est. São Paulo. M.C.Z.

Fig. 6. *Strophocheilus oblongus musculus* J. Bequaert. Paratype. Chaco of Paraguay. N.H.M.Chic. 25915. Deformed shell.

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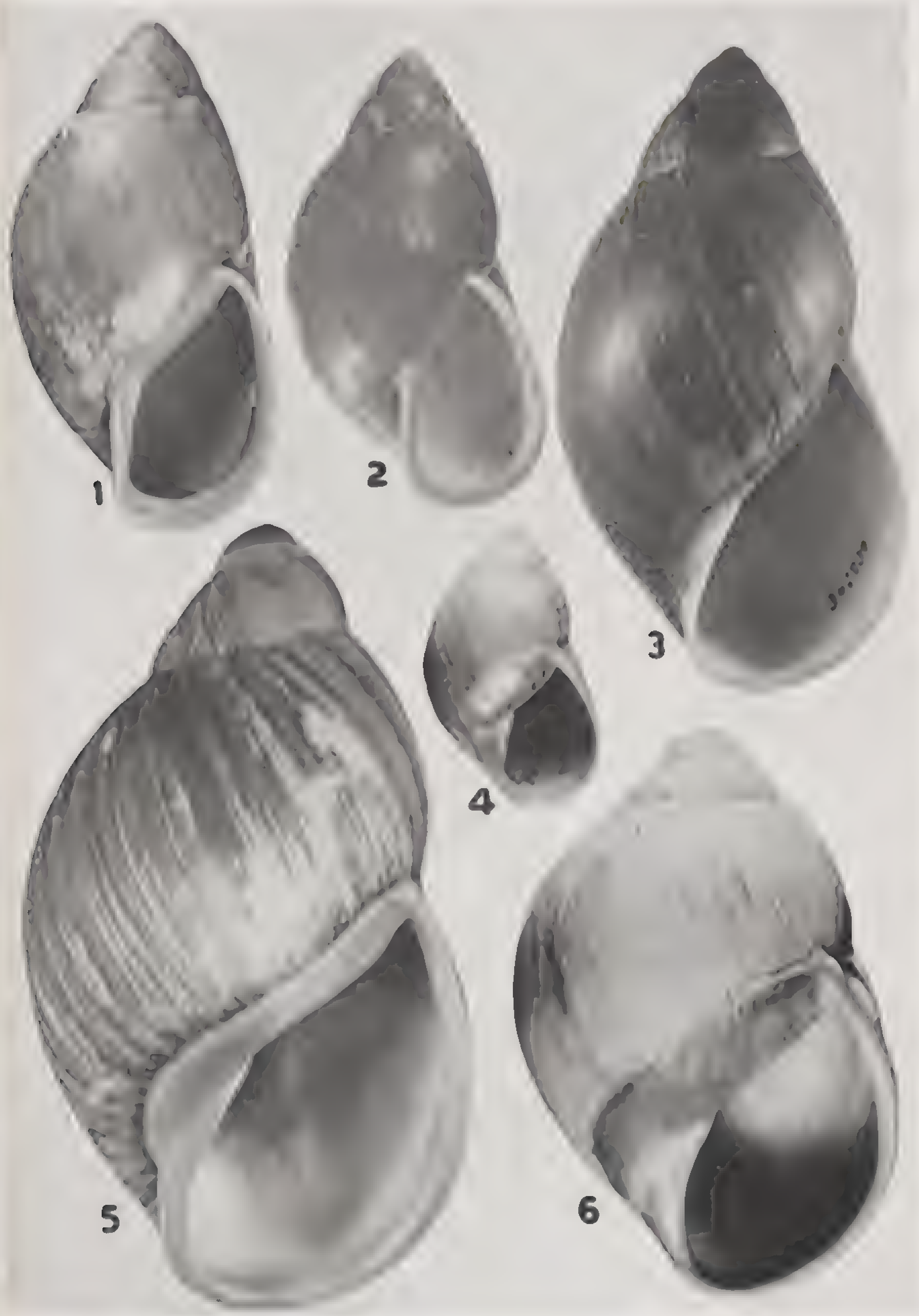
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PLATE 13

PLATE 13

Fig. 1. *Gonyostomus goniostoma* (Férussac). Brazil. M.C.Z.

Figs. 2 and 3. *Strophocheilus bridgesii* (Pfeiffer). Paratypes. Huasco. M.C.Z. 29541.

Fig. 4. *Strophocheilus yporanganus* v. Ihering and Pilsbry. Topotype. Yporanga. M.C.Z. 79107.

Fig. 5. *Strophocheilus leucostoma lacunosus* (d'Orbigny). Carabaya. M.C.Z. 175335.

Fig. 6. *Gonyostomus multicolor* (Rang). Corcovado. M.C.Z. 74441.

Fig. 7. *Strophocheilus sanctipauli* v. Ihering and Pilsbry. Holotype. Botucatu. Ac.N.S.Phila. 71229.

Fig. 8. *Strophocheilus bronni pergranulatus* Pilsbry. Topotype. Piquete. U.S.N.M. 539067.

All Natural Size.

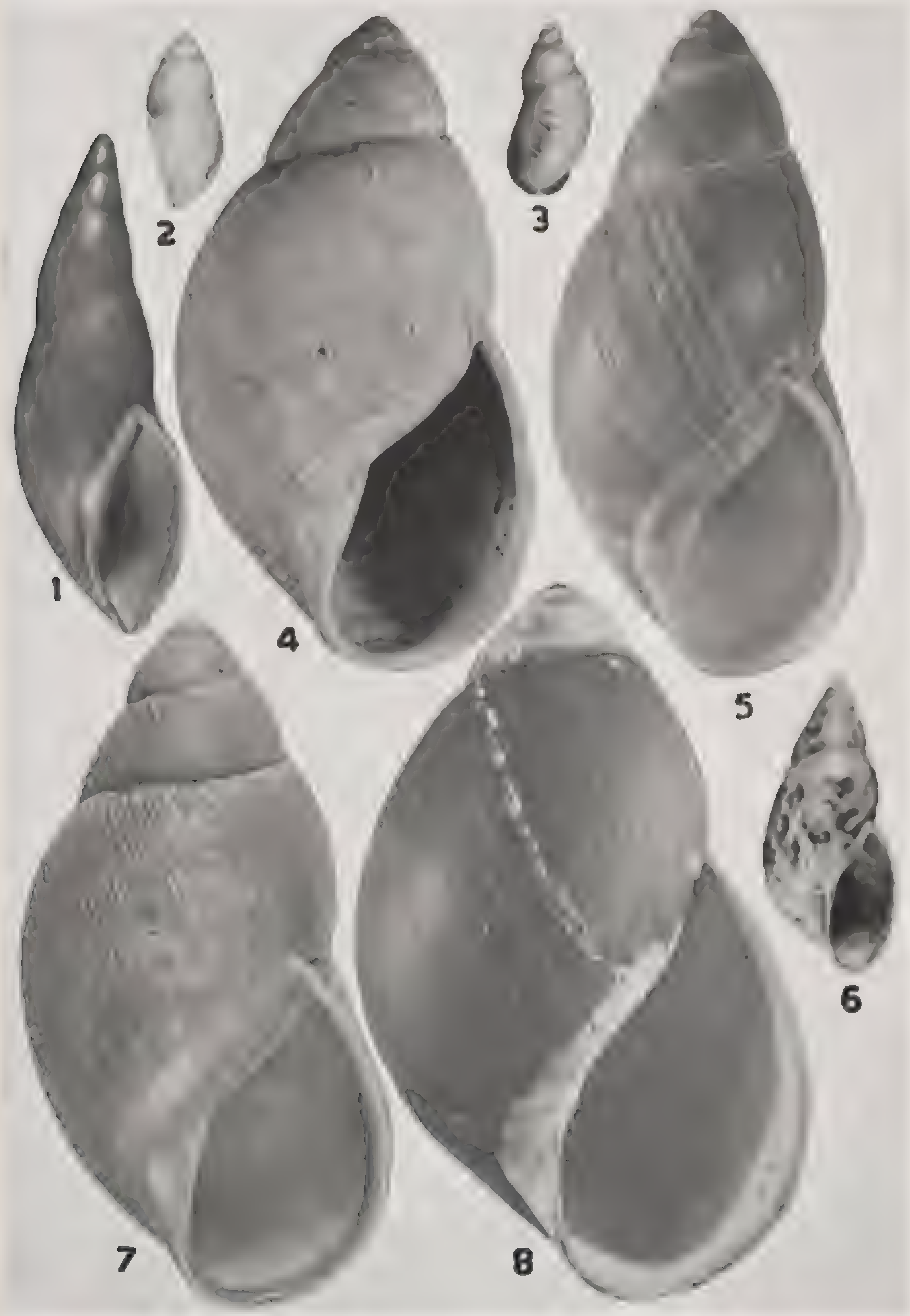
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PLATE 14

PLATE 14

Fig. 1. *Strophocheilus granulosus* (Rang). Brazil. M.C.Z.

Fig. 2. *Gonyostomus egregius* (Pfeiffer). Holotype of *Bulimus hybridus* Gould. Rio de Janeiro. U.S.N.M. 5488.

Fig. 3. *Strophocheilus bridgesii* (Pfeiffer). Paratype. Huasco. M.C.Z. 29541.

Fig. 4. *Gonyostomus turnix* (Gould). Itatiaya. M.C.Z. 75756.

Fig. 5. *Strophocheilus capillaceus* (Pfeiffer). Santa Ana. M.C.Z. 139457.

Fig. 6. *Strophocheilus ovatus grandis* (v. Martens). Ilha São Sebastião. U.S.N.M. 171463.

All Natural Size.

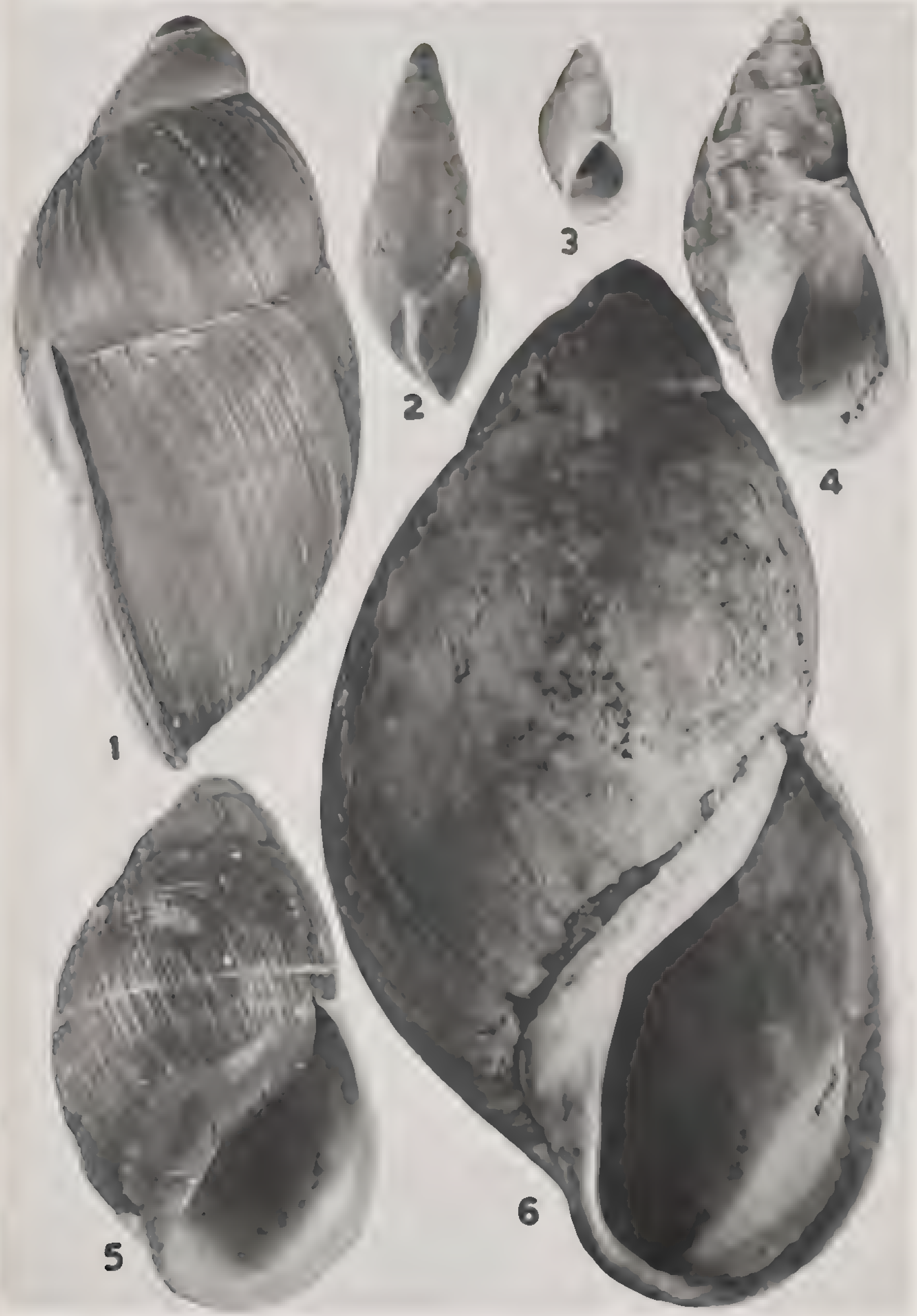
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PLATE 15

PLATE 15

Fig. 1. *Strophocheilus rosaceus* (King and Broderip). Valparaiso. M.C.Z. 87524.

Fig. 2. *Strophocheilus globosus* (v. Martens). Montevideo. M.U.Mich. 35737.

Fig. 3. *Strophocheilus leucostoma lacunosus* (d'Orbigny). Cotype (?). Bolivia. U.S.N.M. 104907

Fig. 4. *Strophocheilus valenciennesii* (Pfeiffer). Brazil. M.C.Z.

Fig. 5. *Strophocheilus sanctipauli pygmaeus* J. Bequaert. Holotype. Brazil. U.S.N.M. 522346.

All Natural Size.

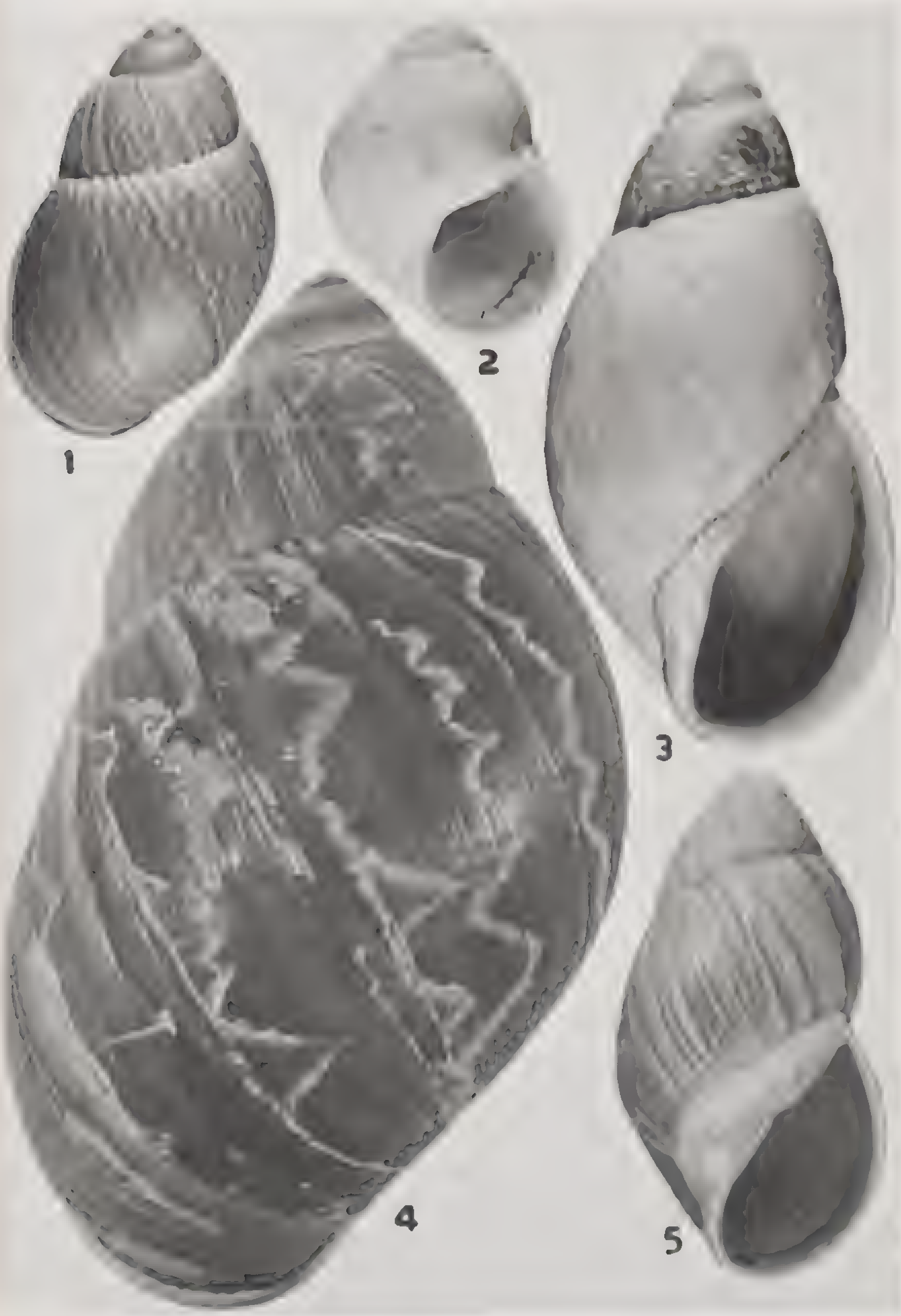
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PLATE 16

PLATE 16

Fig. 1. *Strophocheilus pudicus debilis* J. Bequaert. Holotype. Itapicuru. M.C.Z. 151511.

Fig. 2. *Gonyostomus goniostoma* (Férussac). Copy of Mawe's type figure of the species (1812).

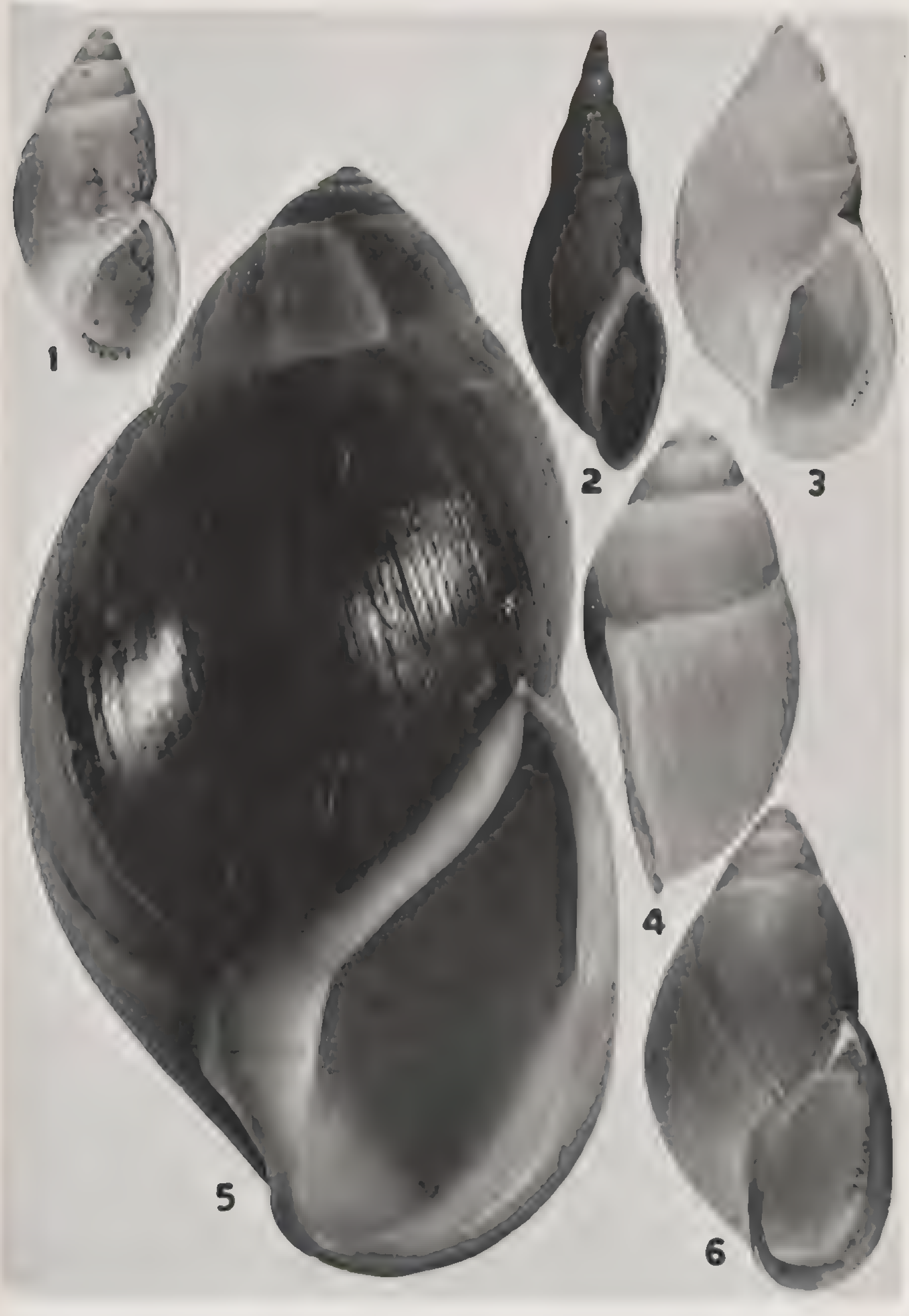
Fig. 3. *Strophocheilus pudicus* (O. F. Müller). Bahia. M.C.Z. 75272.

Fig. 4. *Strophocheilus rosaceus* (King and Broderip). Valparaiso. M.C.Z. 87524.

Fig. 5. *Strophocheilus ovatus* (O. F. Müller). Brazil. M.C.Z.

Fig. 6. *Strophocheilus erythrosoma* Pilsbry. Holotype of *S. porphyrostoma* Clench and Archer. Taquaral. M.C.Z. 79108.

All Natural Size.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PLATES 17

PLATE **17**

Fig. 1. *Strophocheilus separabilis* Fulton. Ambo. M.C.Z. 139496.

Fig. 2. *Strophocheilus pudicus debilis* J. Bequaert. Holotype. Itapicuru. M.C.Z. 151511.

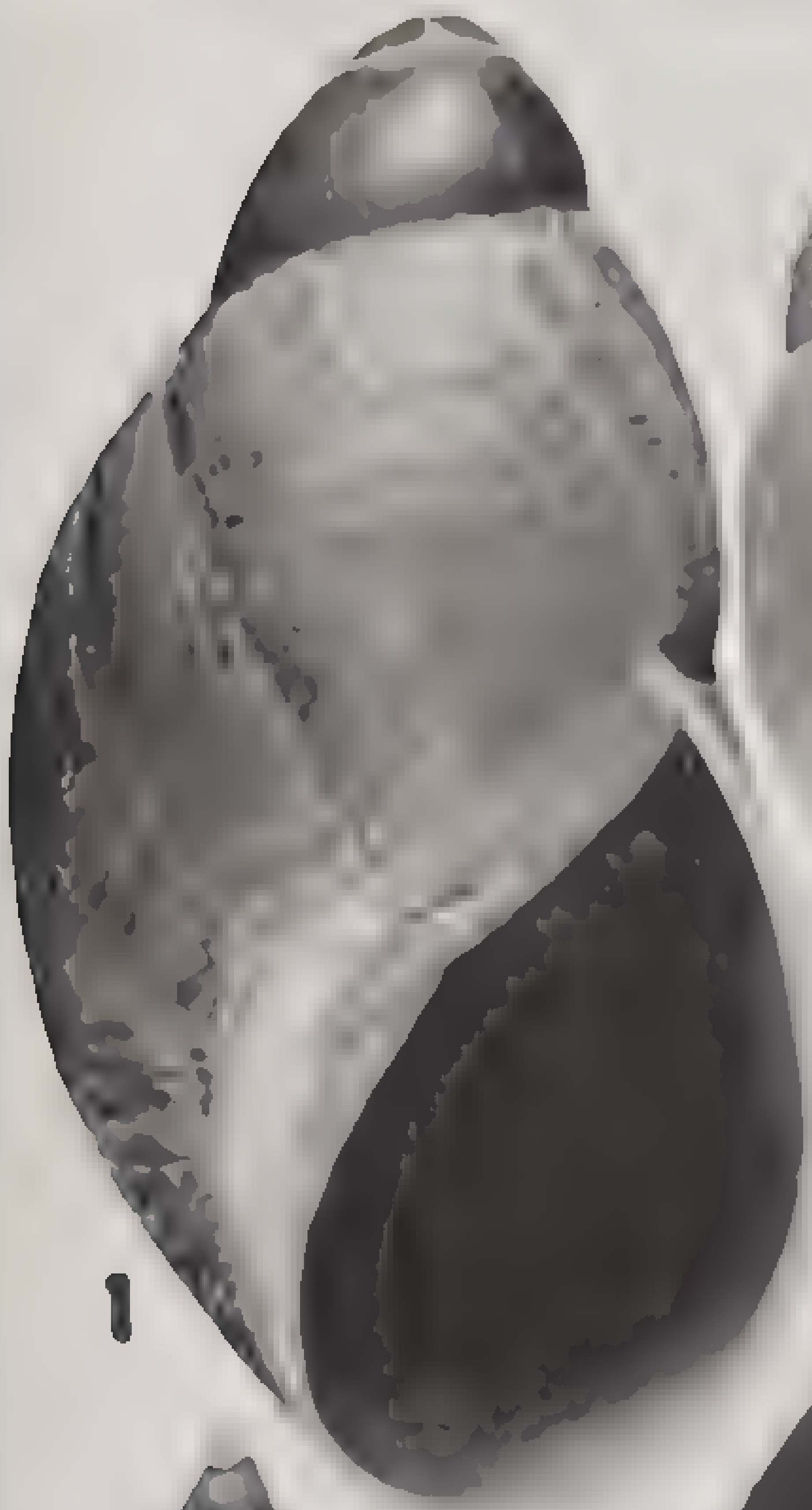
Fig. 3. *Strophocheilus pilsbryi* v. Ihering. Rio de Janeiro. M.C.Z. 75747.

Fig. 4. *Gonyostomus multicolor* (Rang). Corcovado. M.C.Z. 74441.

Fig. 5. *Strophocheilus calus* Pilsbry. Brazil. M.C.Z.

Fig. 6. *Strophocheilus terrestris gummatus* (Hidalgo). Brazil. M.C.Z.

All Natural Size.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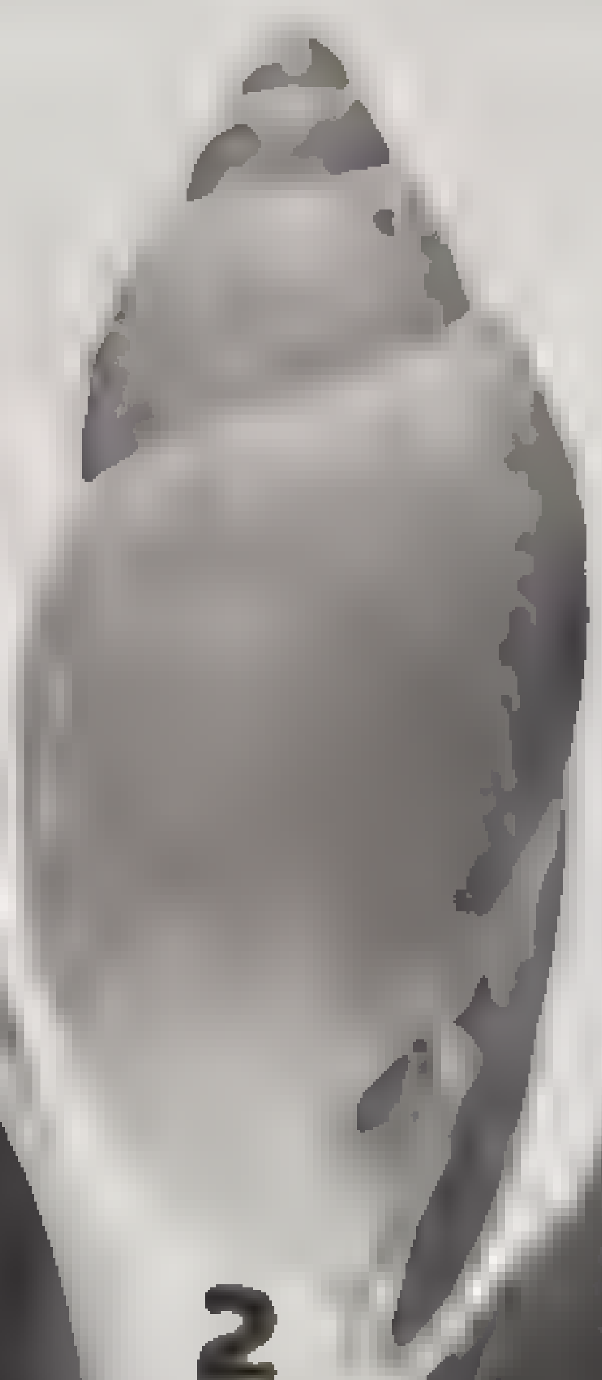
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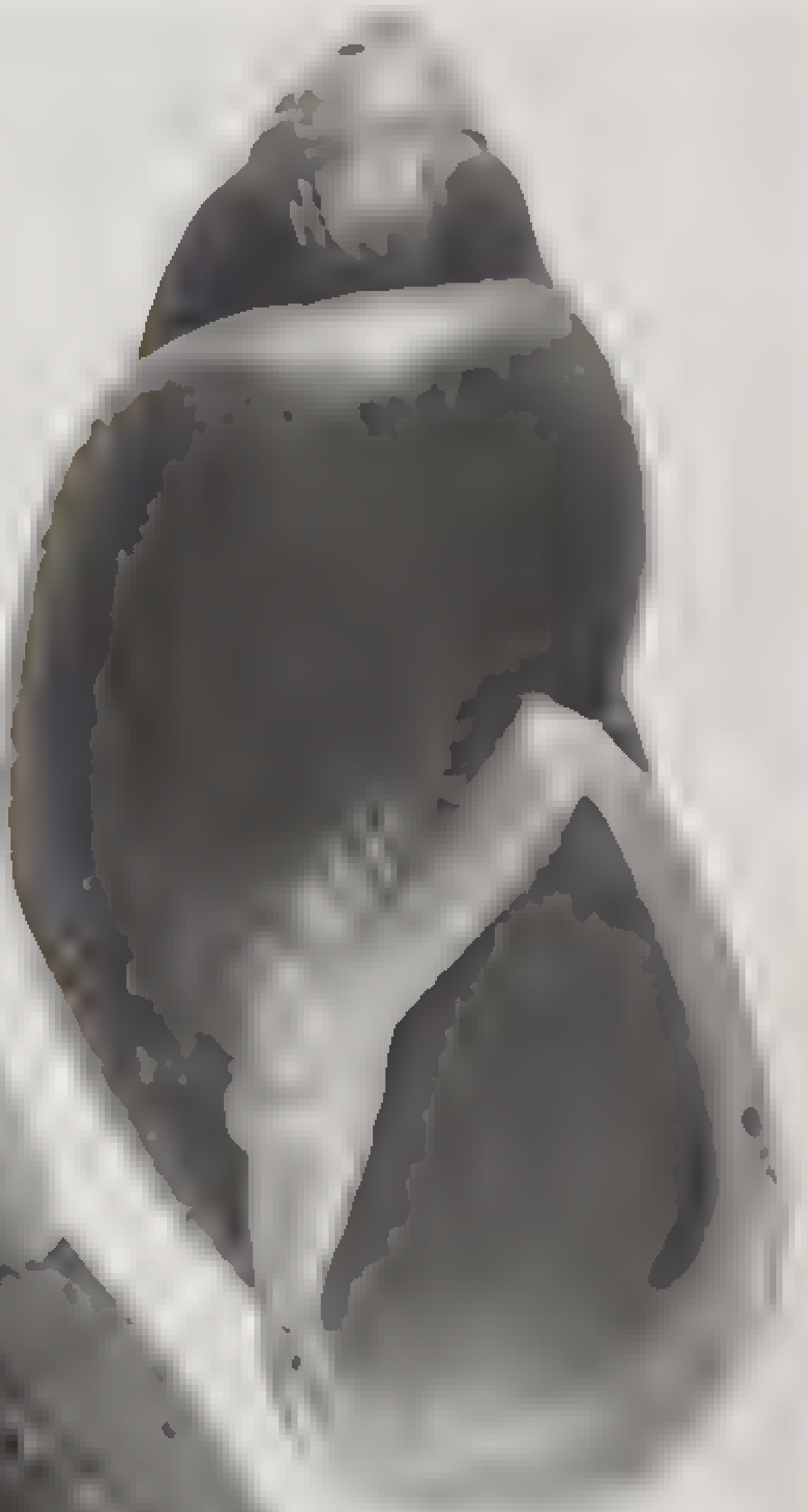
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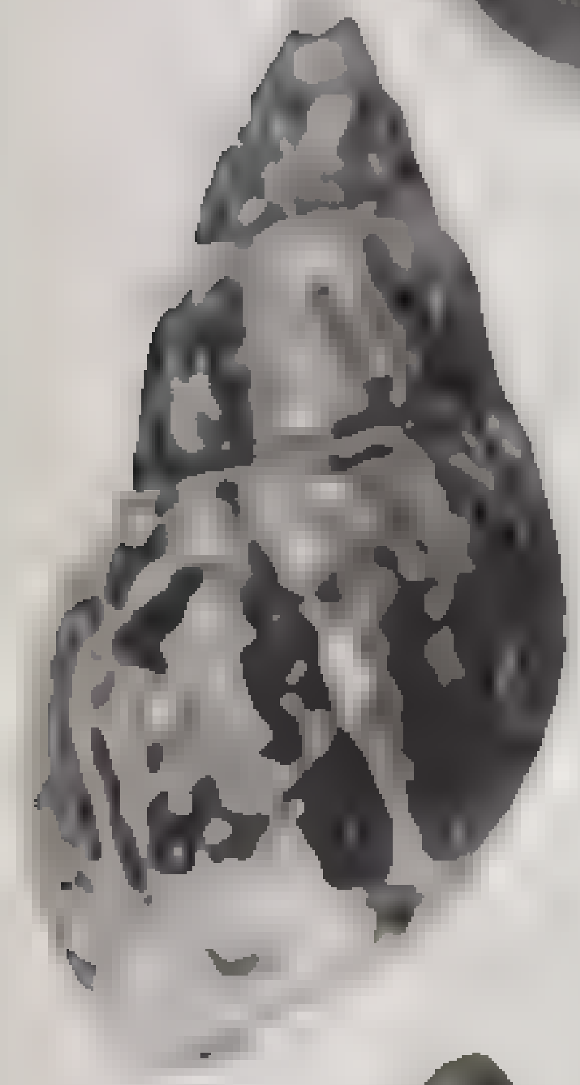
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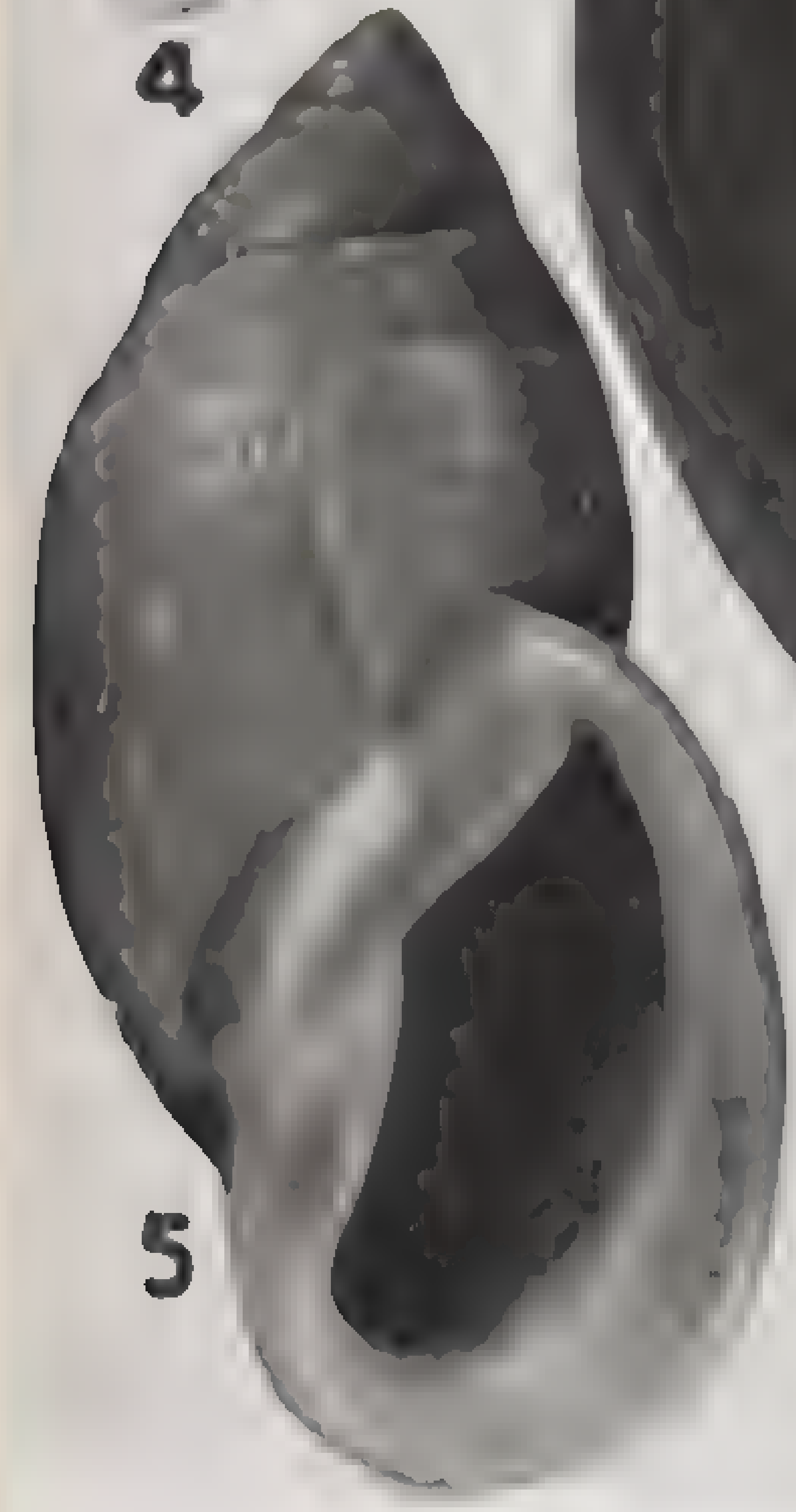
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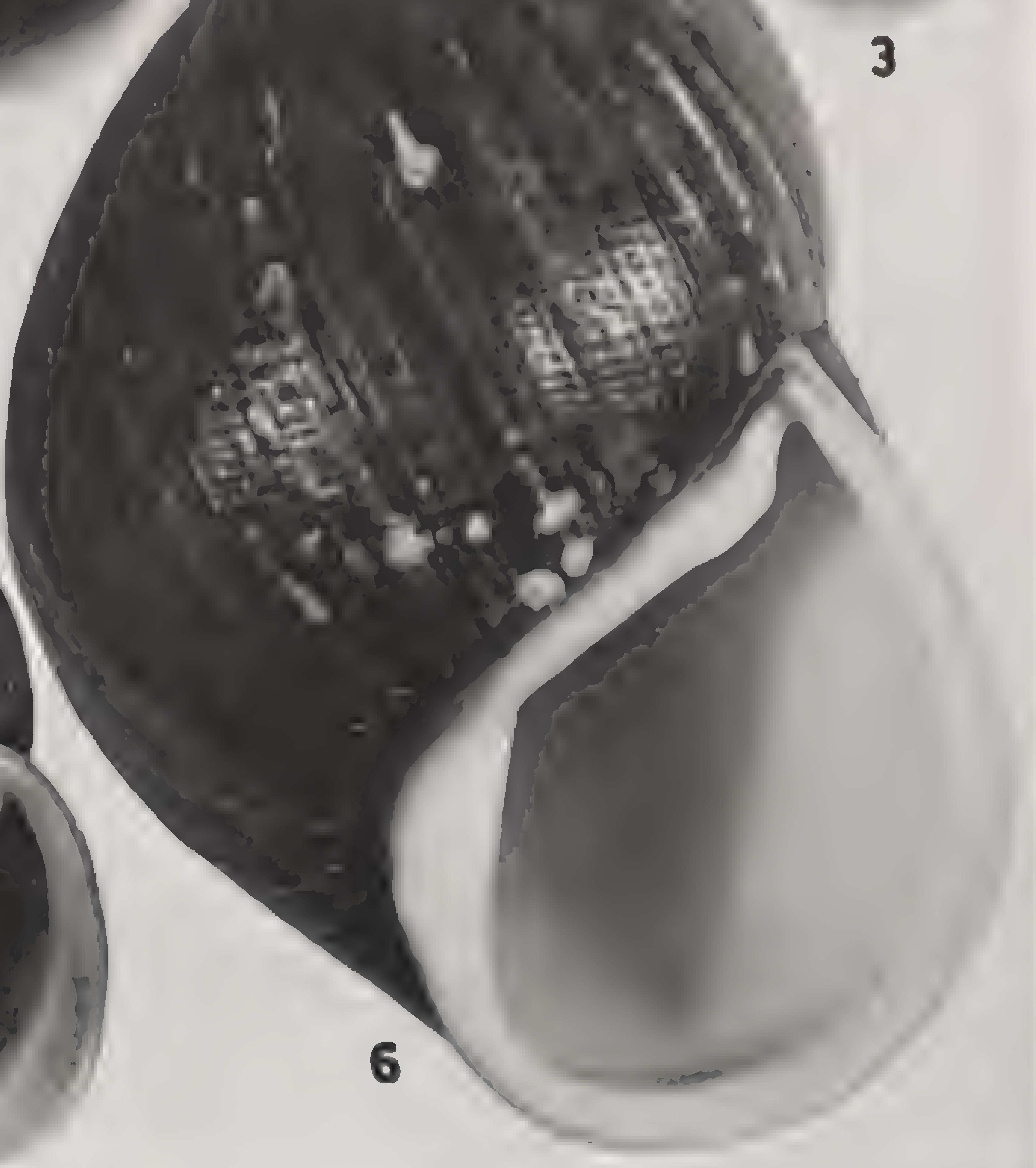
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PLATE 18

PLATE 18

Fig. 1. *Strophocheilus terrestris* (Spix). Bahia. M.C.Z. 124840.

Fig. 2. *Strophocheilus planidens* (Michelin). Brazil. M.C.Z.

Fig. 3. *Strophocheilus intertextus* Pilsbry. Holotype. Corumbá. Ac.N.S.-Phila. 69158.

Fig. 4. *Strophocheilus oblongus* (O. F. Müller). Abnormal. Barbados. M.C.Z. 146693.

All Natural Size.

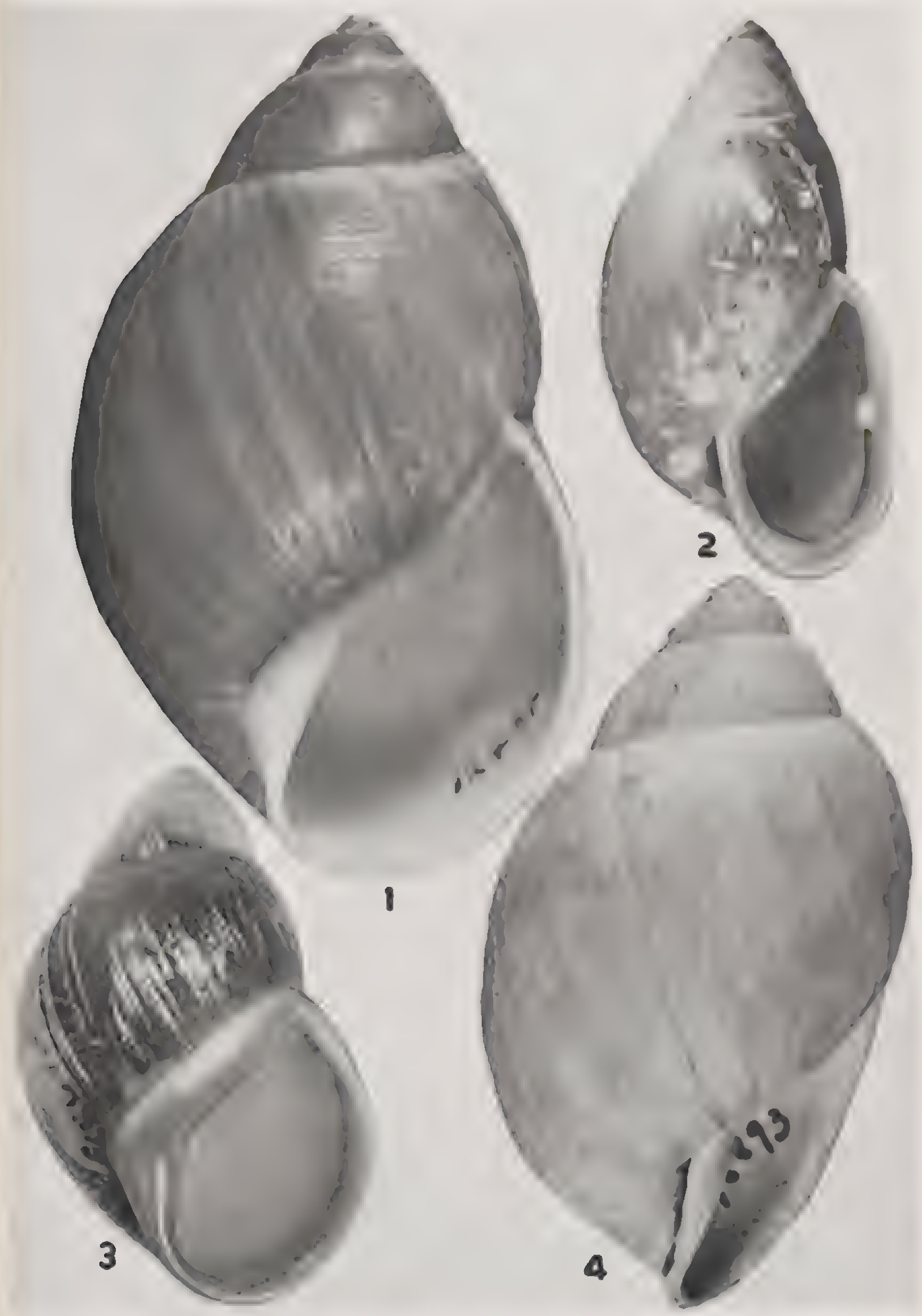
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PLATE 19

PLATE 19

Fig. 1. *Strophocheilus pudicus* (O. F. Müller). Bahia. M.C.Z. 31382.

Fig. 2. *Strophocheilus oblongus conicus* J. Bequaert. Holotype. Est. Maranhão. M.C.Z. 74405.

Fig. 3. *Strophocheilus calus* Pilsbry. Holotype. Brazil. A.M.N.H. J4668.

Fig. 4. *Strophocheilus maximus vestitus* Pilsbry. Holotype. Cochabamba (?). Ac.N.S.Phila. 138105.

Fig. 5. *Strophocheilus proclivis* (v. Martens). Est. Rio Grande do Sul. M.U.Mich. 144481.

All Natural Size.

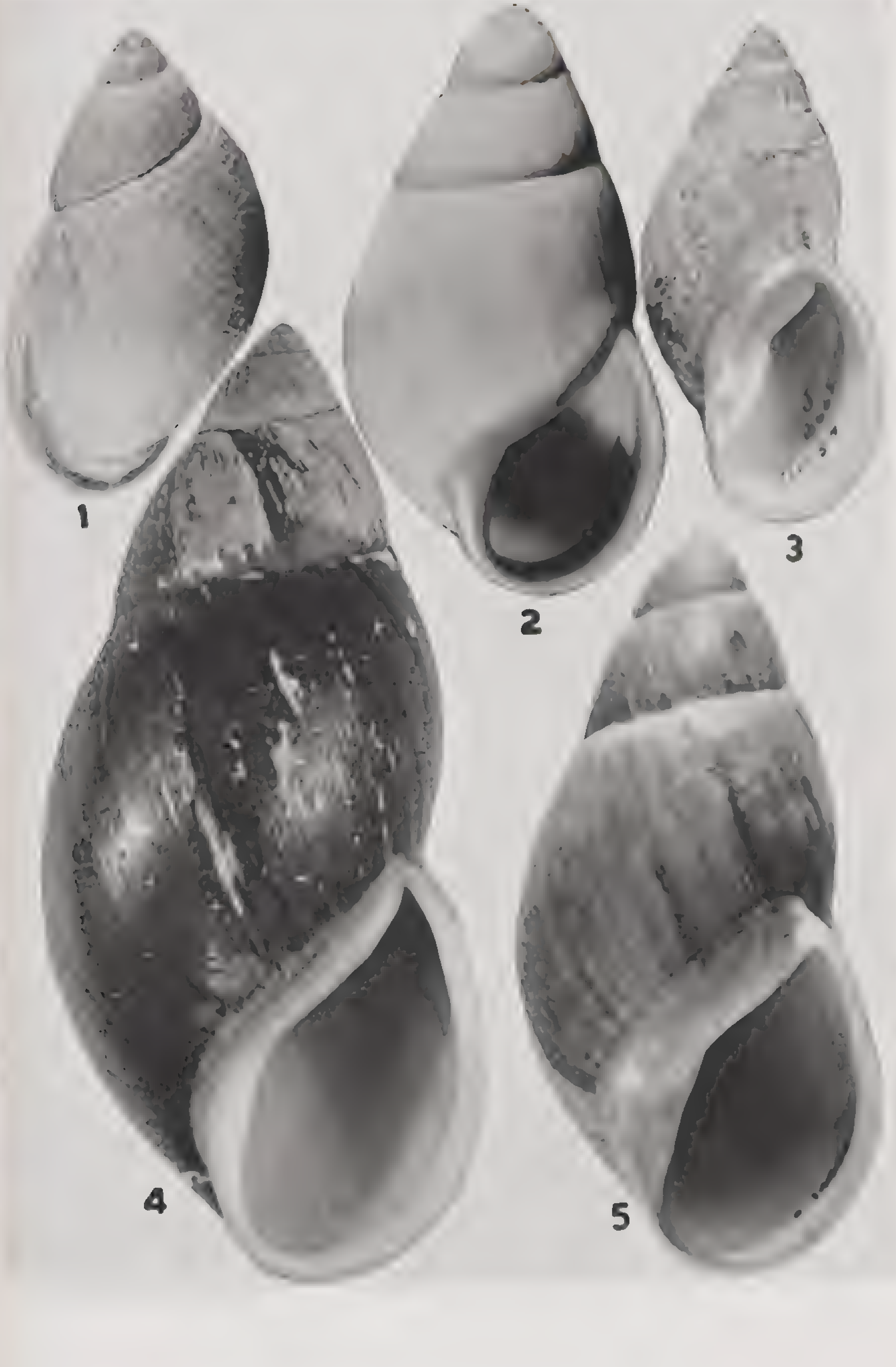
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PLATE 20

PLATE 20

Fig. 1. *Strophocheilus oblongus musculus* J. Bequaert. Paratype. Entre Ríos. M.C.Z. 124838.

Fig. 2. *Strophocheilus globosus* (v. Martens). Holotype of *S. felipponei* v. Ihering. Paysandú. D.Z.S.P. 7885.

Fig. 3. *Strophocheilus milleri kronei* v. Ihering. Topotype. Rio Grande. M.C.Z. 179242.

Fig. 4. *Gonyostomus goniostoma* (Férussac). Brazil. M.C.Z.

Fig. 5. *Gonyostomus turnix albolabiatus* Jaeckel. Paratype. Sa. Rosa. M.C.Z. 179248.

Fig. 6. *Strophocheilus valenciennesii* (Pfeiffer). Brazil. M.C.Z.

All Natural Size.

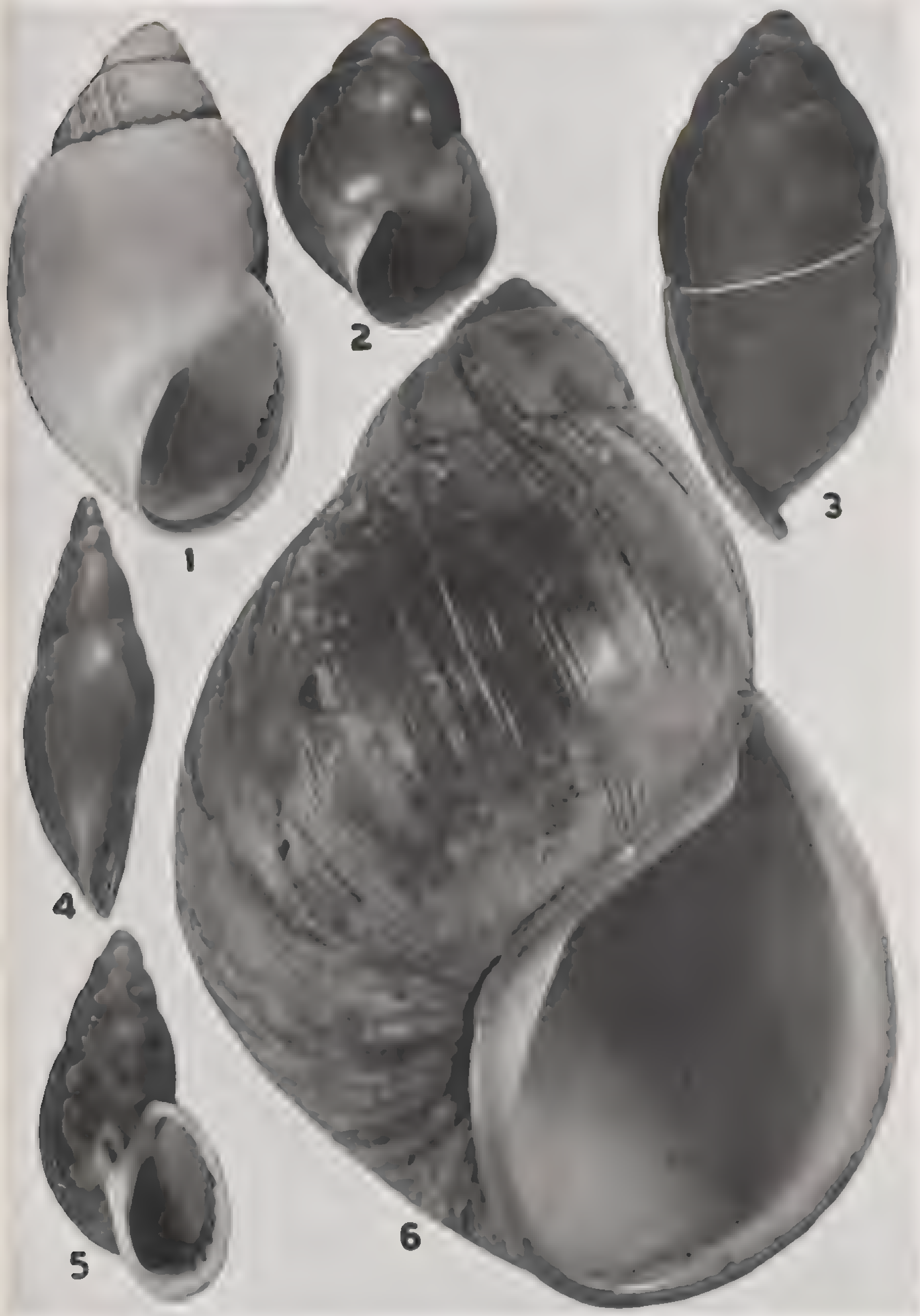
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PLATE 21

PLATE **21**

Fig. 1. *Strophocheilus bronni fragilior* v. Ihering. Topotype. Rio Grande. M.C.Z. 179224.

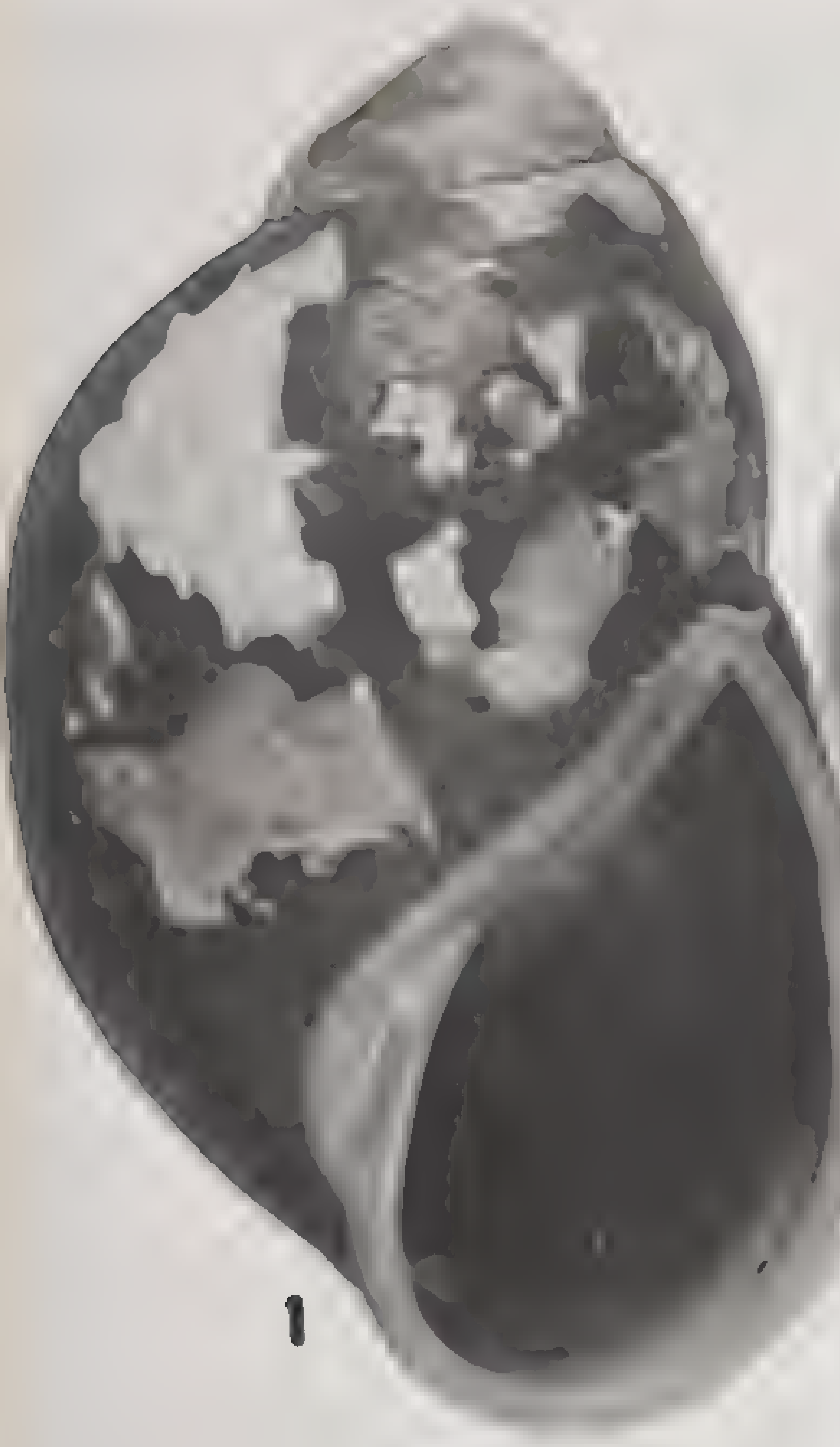
Fig. 2. *Gonyostomus turnix* (Gould). Itatiaya. M.C.Z. 45756.

Fig. 3. *Strophocheilus planidens jaussaudi* (Lange de Morretes). Holotype. Morungaba. D.Z.S.P. 14131.

Fig. 4. *Strophocheilus oblongus haemastomus* (Scopoli). Sinistral. A.M.N.H. 53334.

Fig. 5. *Strophocheilus maximus* (Sowerby). South America. M.C.Z.

All Natural Size.



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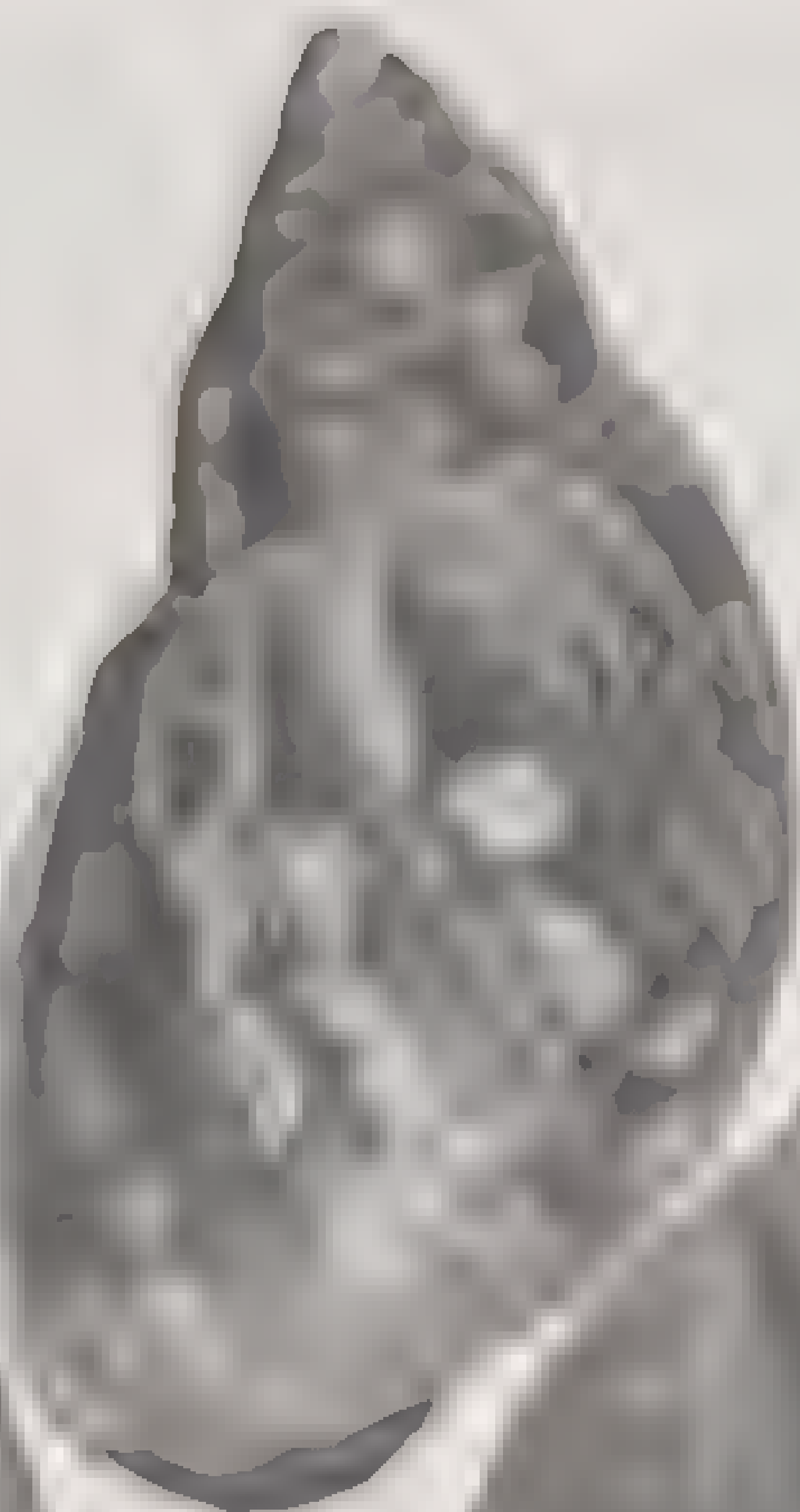

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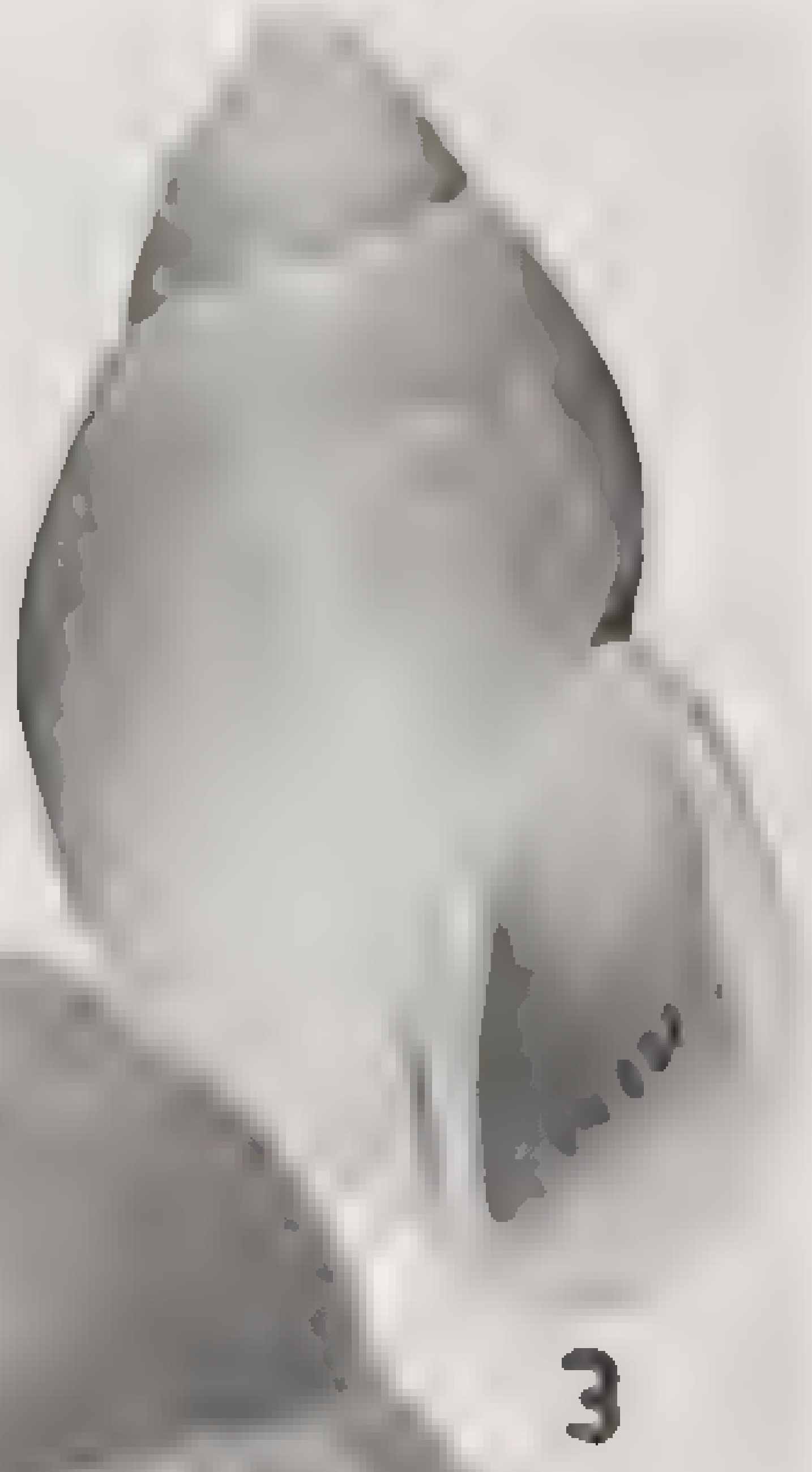

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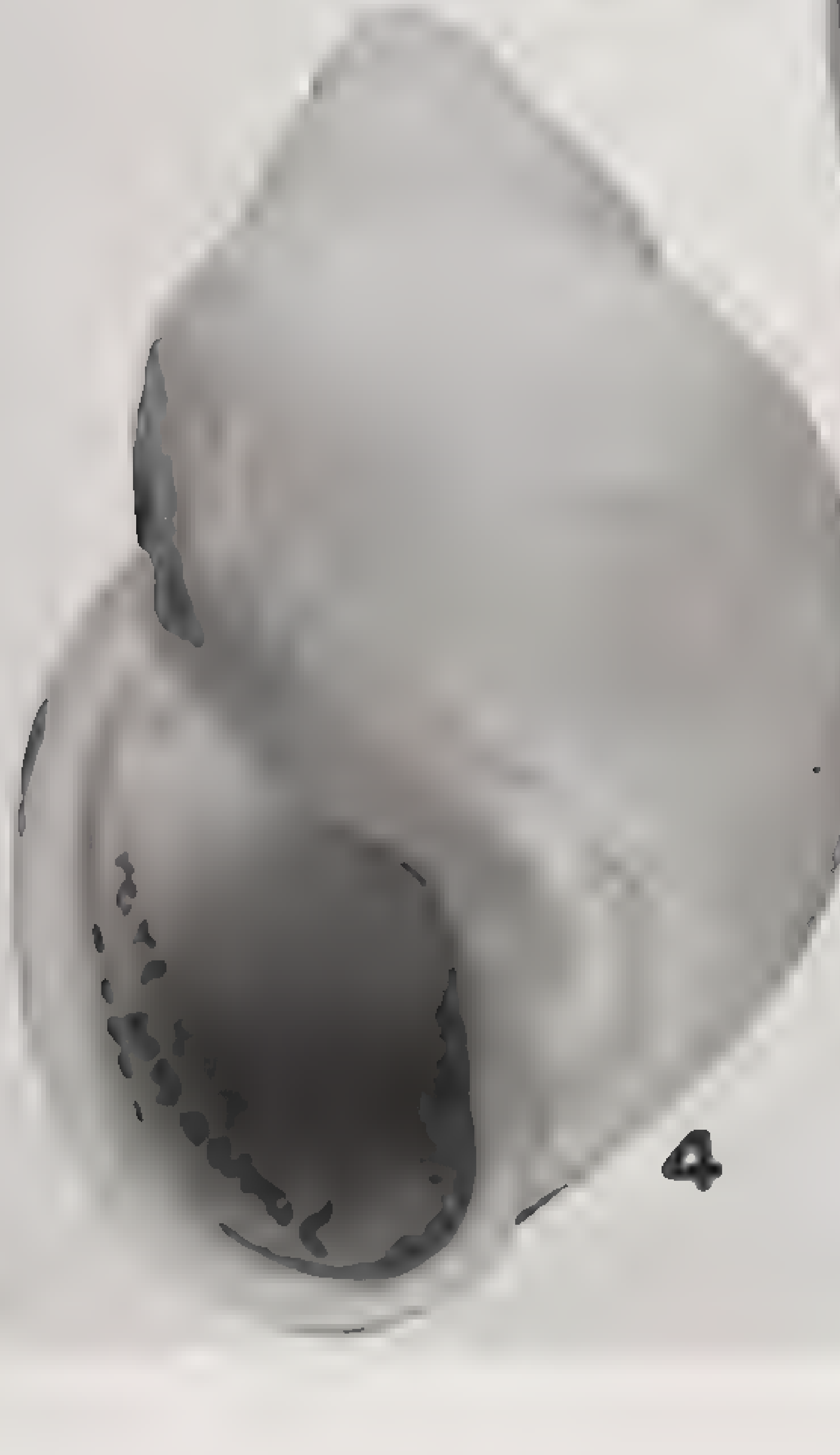

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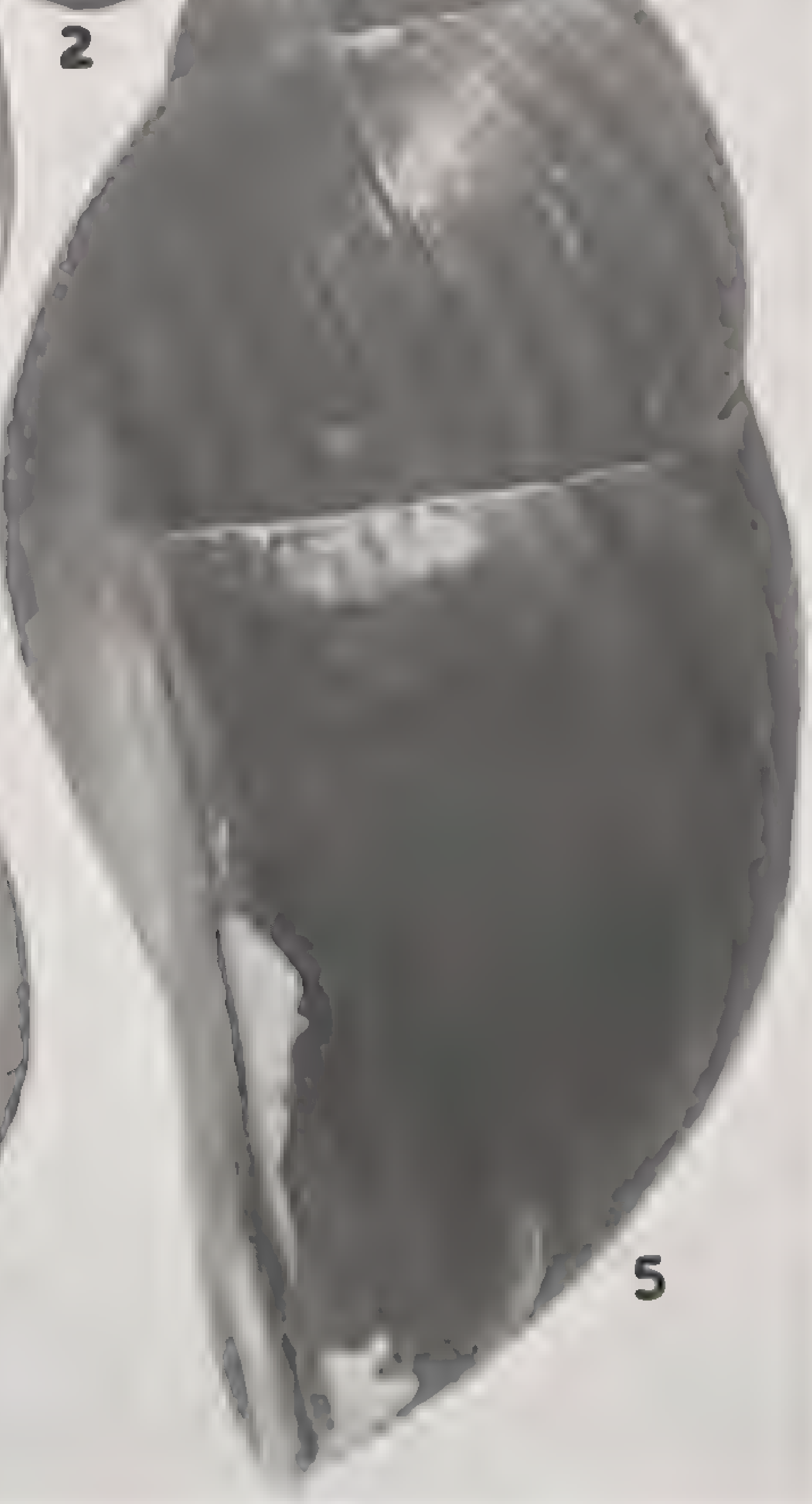

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PLATE 22

PLATE 22

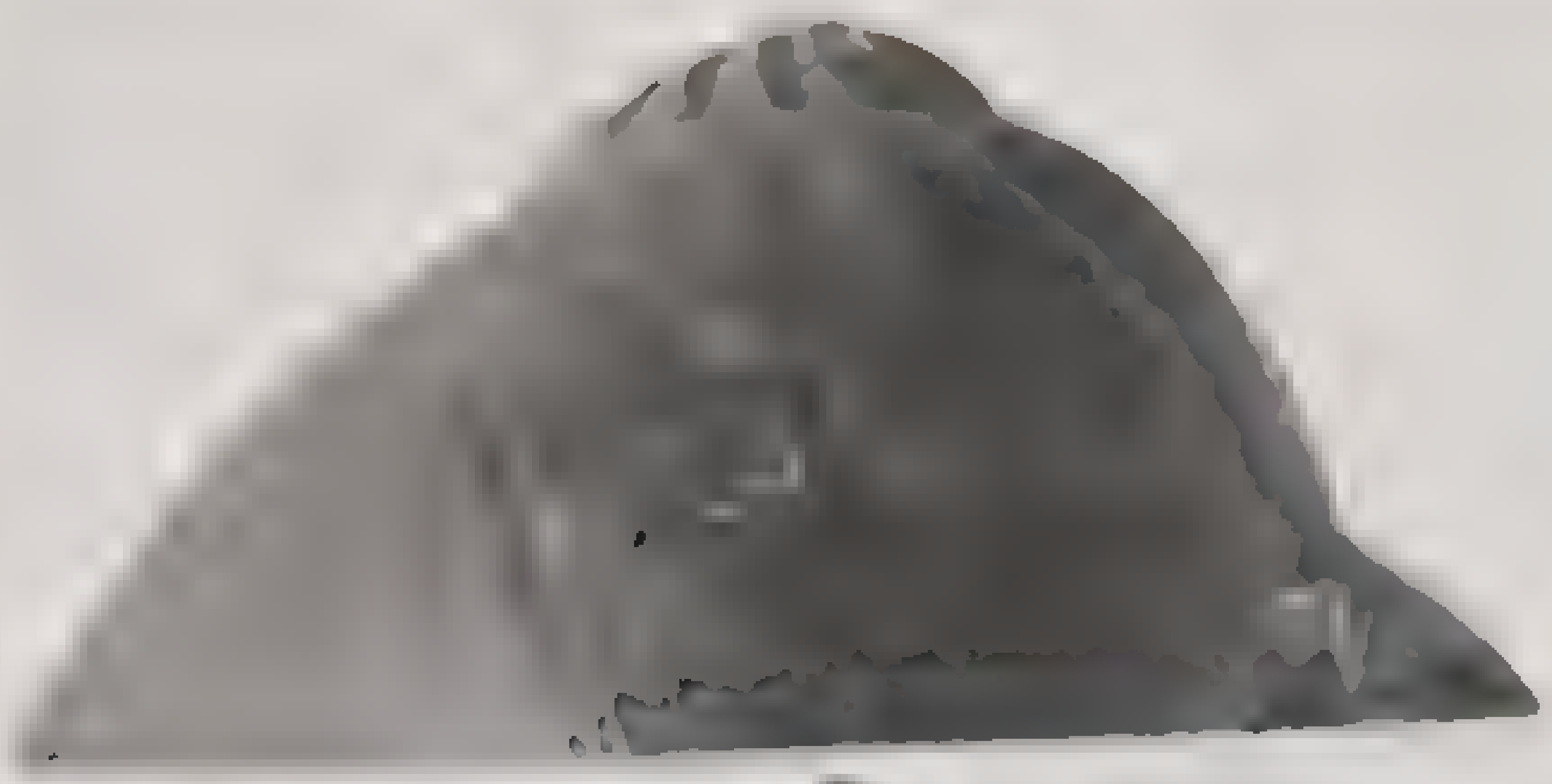
Fig. 1. *Strophocheilus bronni* (Pfeiffer). Serra de Macahé. M.C.Z. 179232. Summit of young shell, X 2.

Fig. 2. *Strophocheilus oblongus albus* (Bland and Binney). Holotype of *S. oblongus* var. *tobagoensis* Pilsbry. Tobago. Ac.N.S.Phila. 66351.

Fig. 3. *Strophocheilus oblongus perelongatus* J. Bequaert. Holotype. Río Guamal. M.C.Z. 145202.

Fig. 4. *Strophocheilus milleri* (Sowerby). Brazil, M.C.Z.

Natural Size, except Fig. 1.



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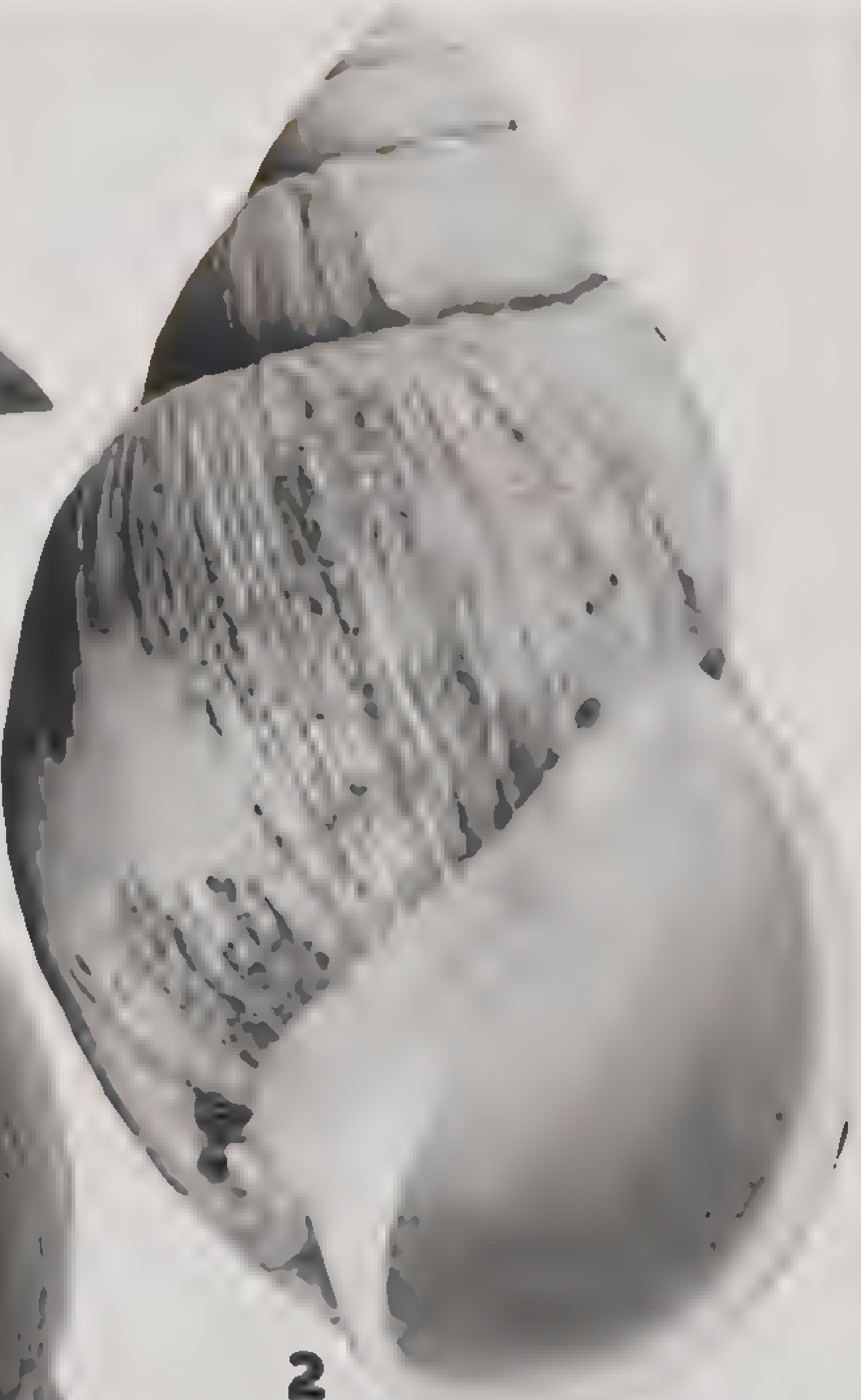

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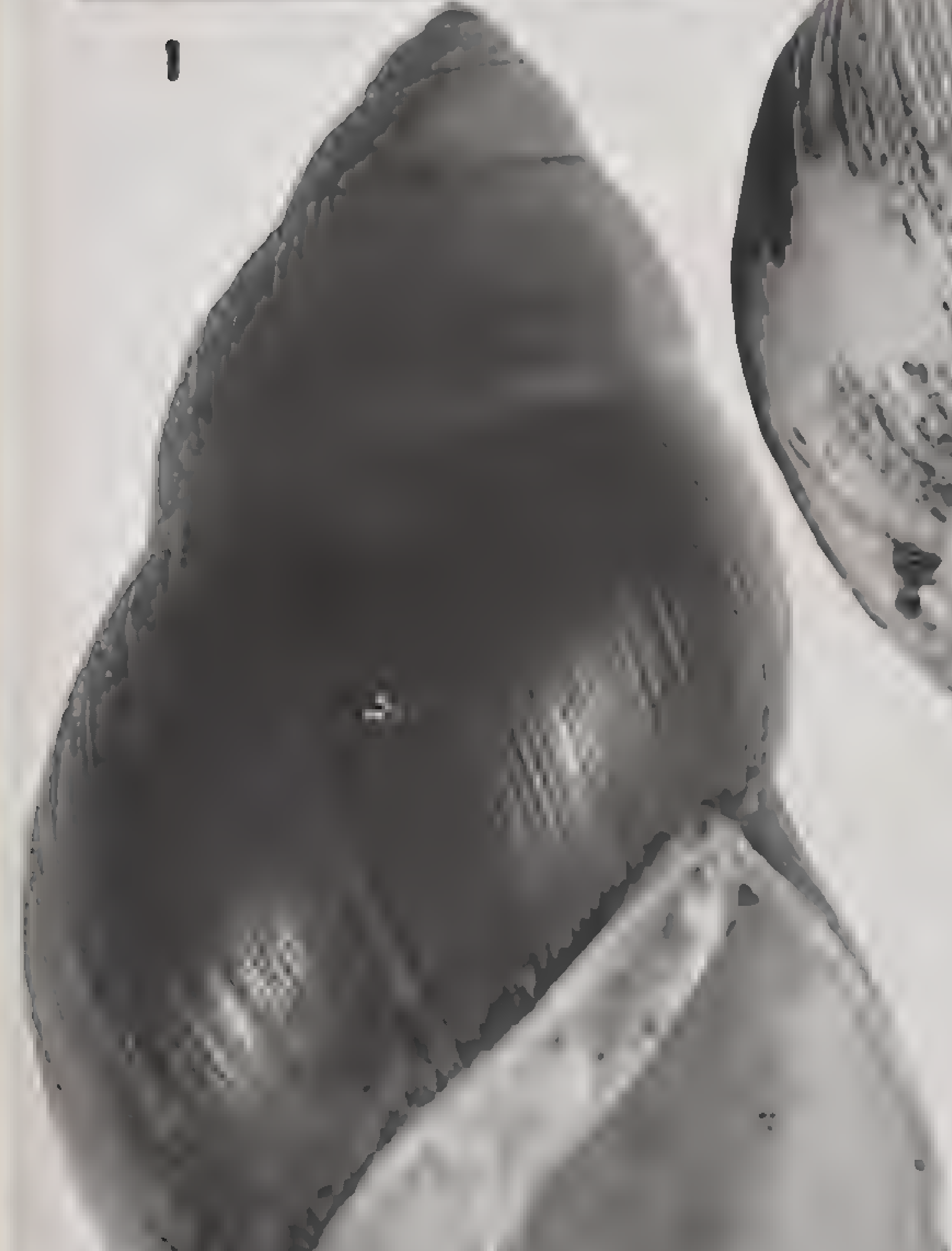

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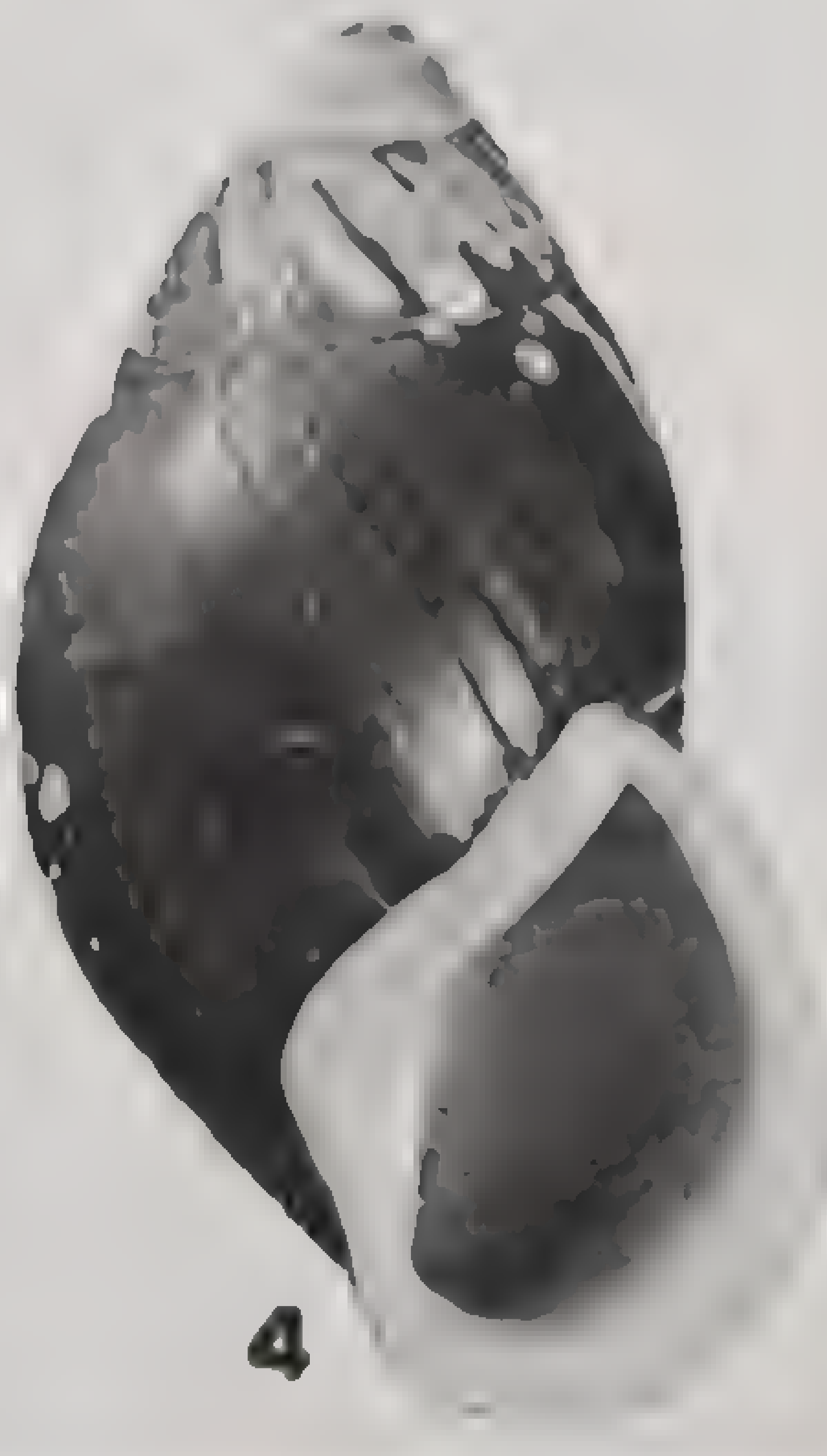

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PLATE 23

PLATE 23

Fig. 1. *Strophocheilus oblongus conicus* J. Bequaert. Paratype, Certão de Bahia. U.S.N.M. 225964.

Fig. 2. *Gonyostomus goniostoma* (Férussac). Brazil. M.C.Z.

Fig. 3. *Strophocheilus oblongus conicus* J. Bequaert. Paratype. Est. Bahia. M.N.H.Chic. 11692.

Fig. 4. *Strophocheilus leucostoma* (Sowerby). Ambo. M.C.Z. 139495.

Fig. 5. *Strophocheilus oblongus* (O. F. Müller). Muzo. M.C.Z. 64227.

All Natural Size.

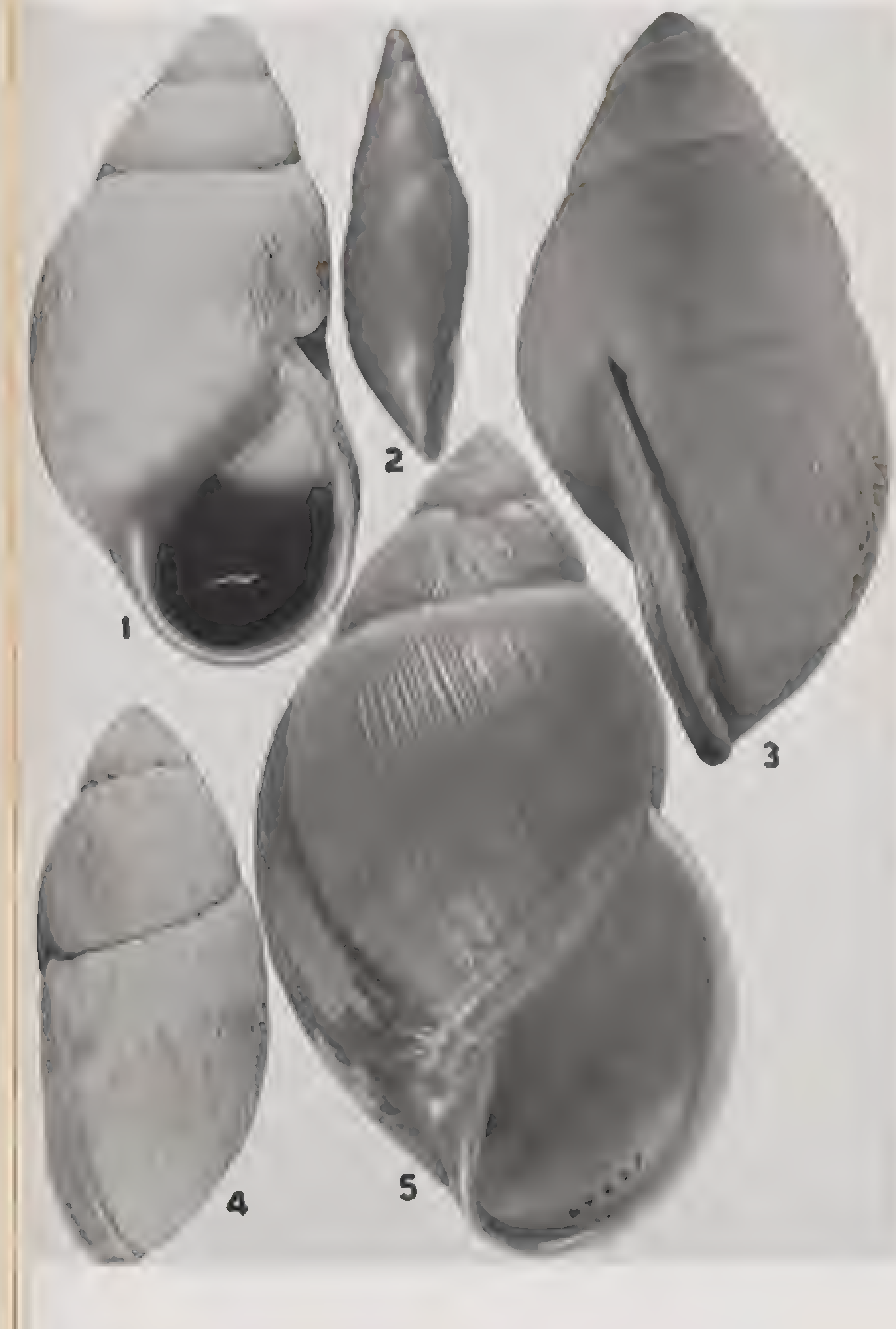
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PLATE 24

PLATE 24

Fig. 1. *Strophocheilus indigens* Fulton. Copy of original figure of type.

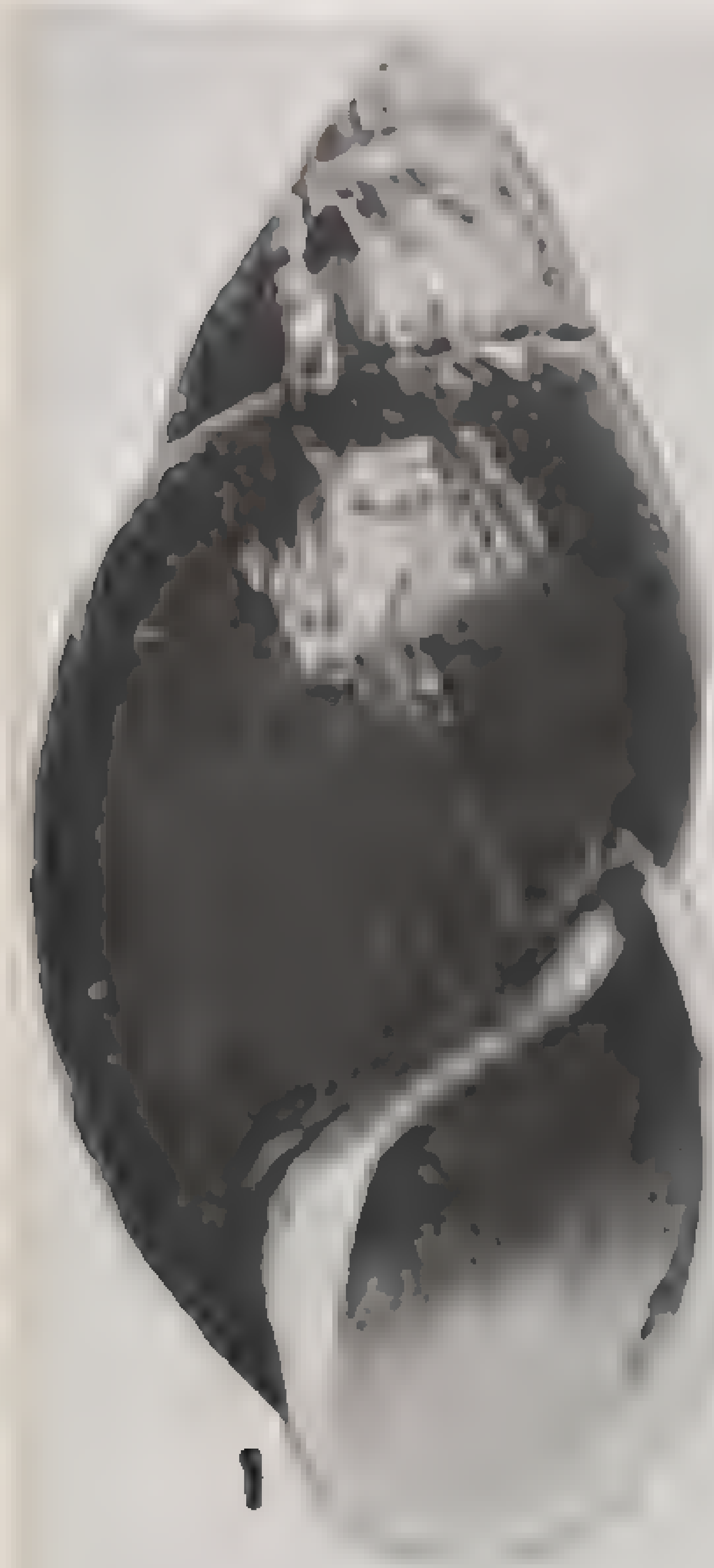
Fig. 2. *Strophocheilus sanctipauli eyerdami* J. Bequaert. Holotype. Tartagal. M.C.Z. 132300.

Fig. 3. *Strophocheilus pudicus roseolabris* J. Bequaert. Paratype. Bahia. D.Z.S.P. 3224.

Fig. 4. *Strophocheilus bronni pergranulatus* Pilsbry. Holotype. Piquete. Ac.N.S.Phila. 71231.

Fig. 5. *Strophocheilus oblongus haemastomus* (Scopoli). Tres Lagoas. M.C.Z. 138872.

All Natural Size.



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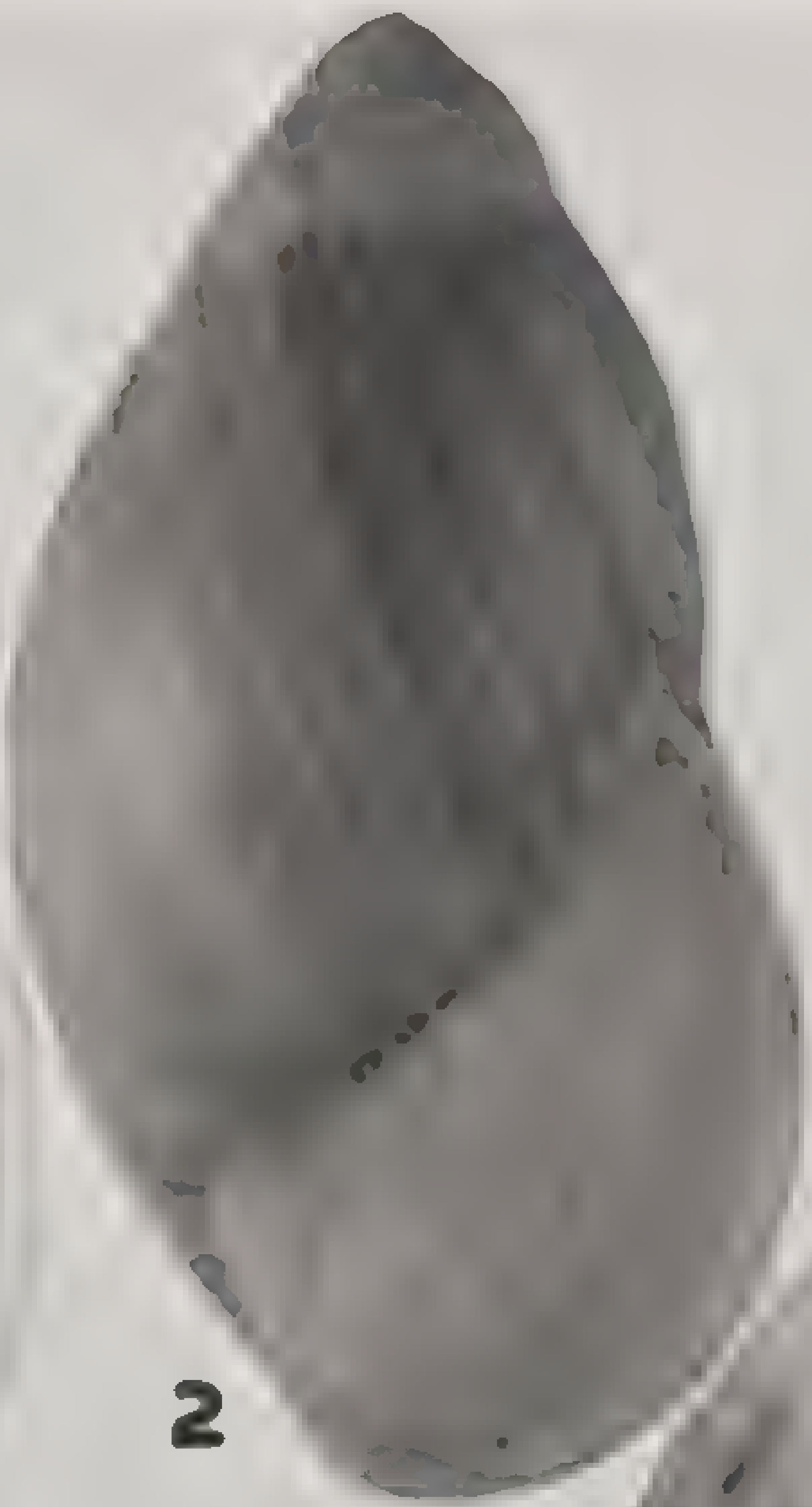

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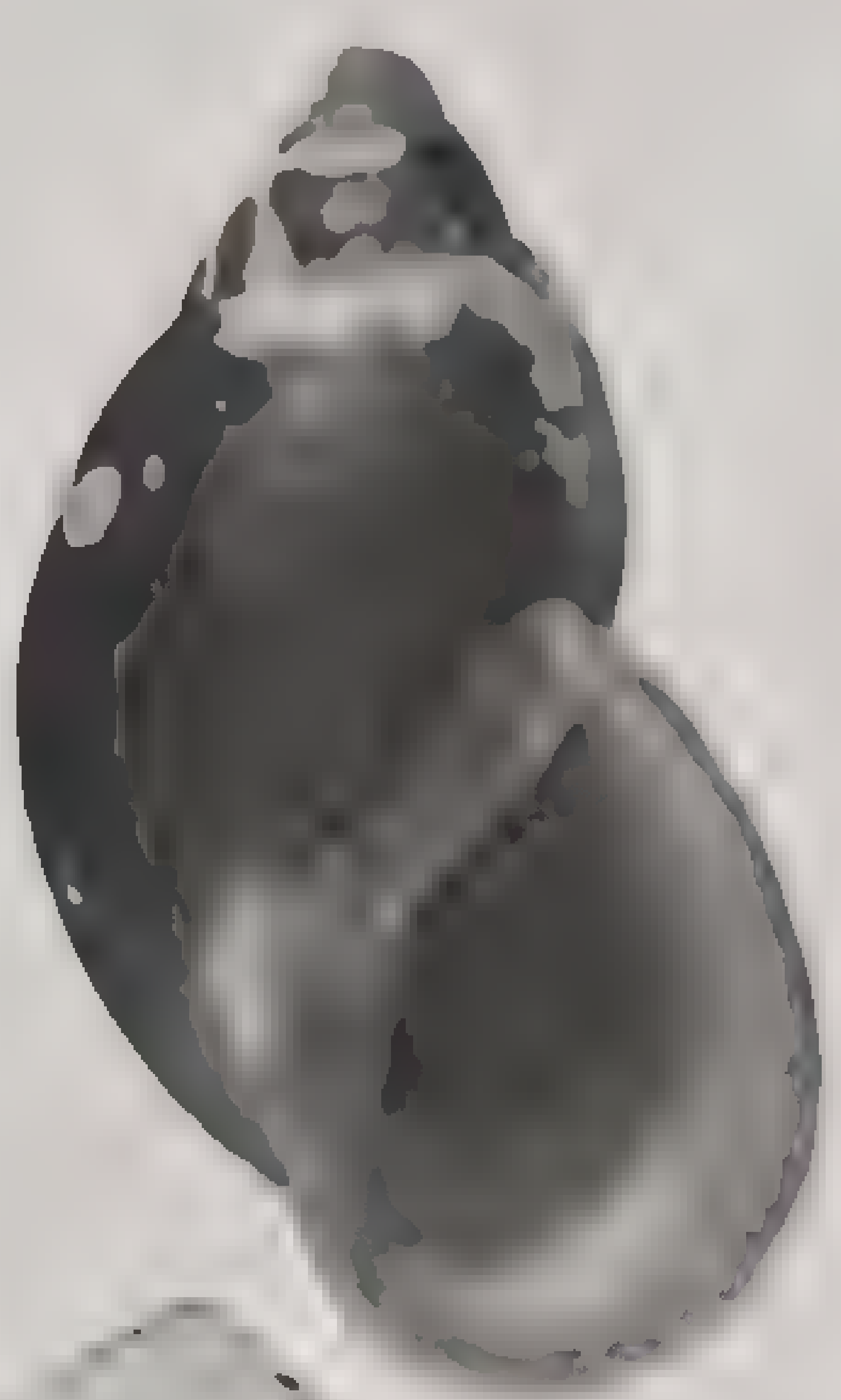

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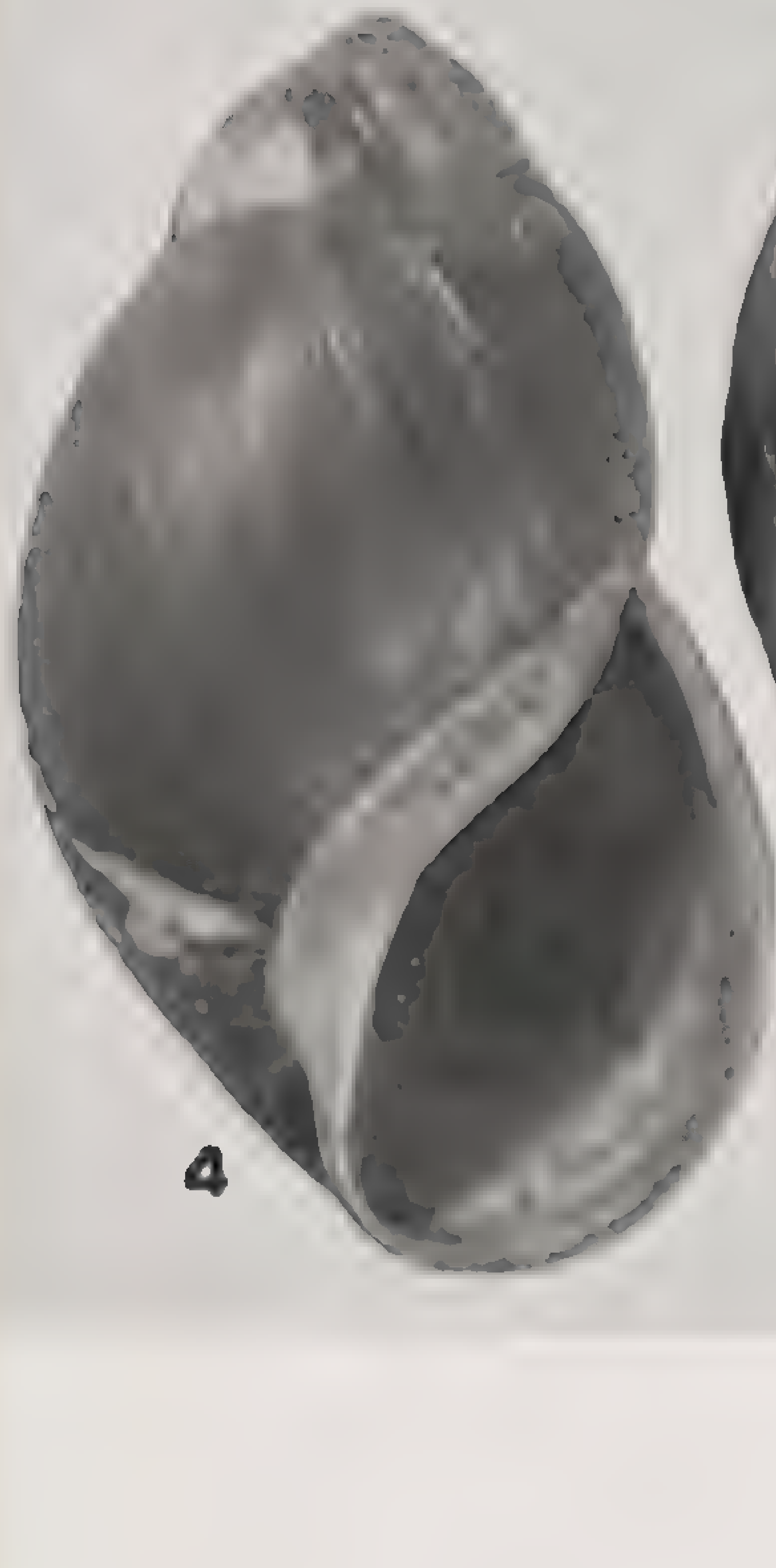

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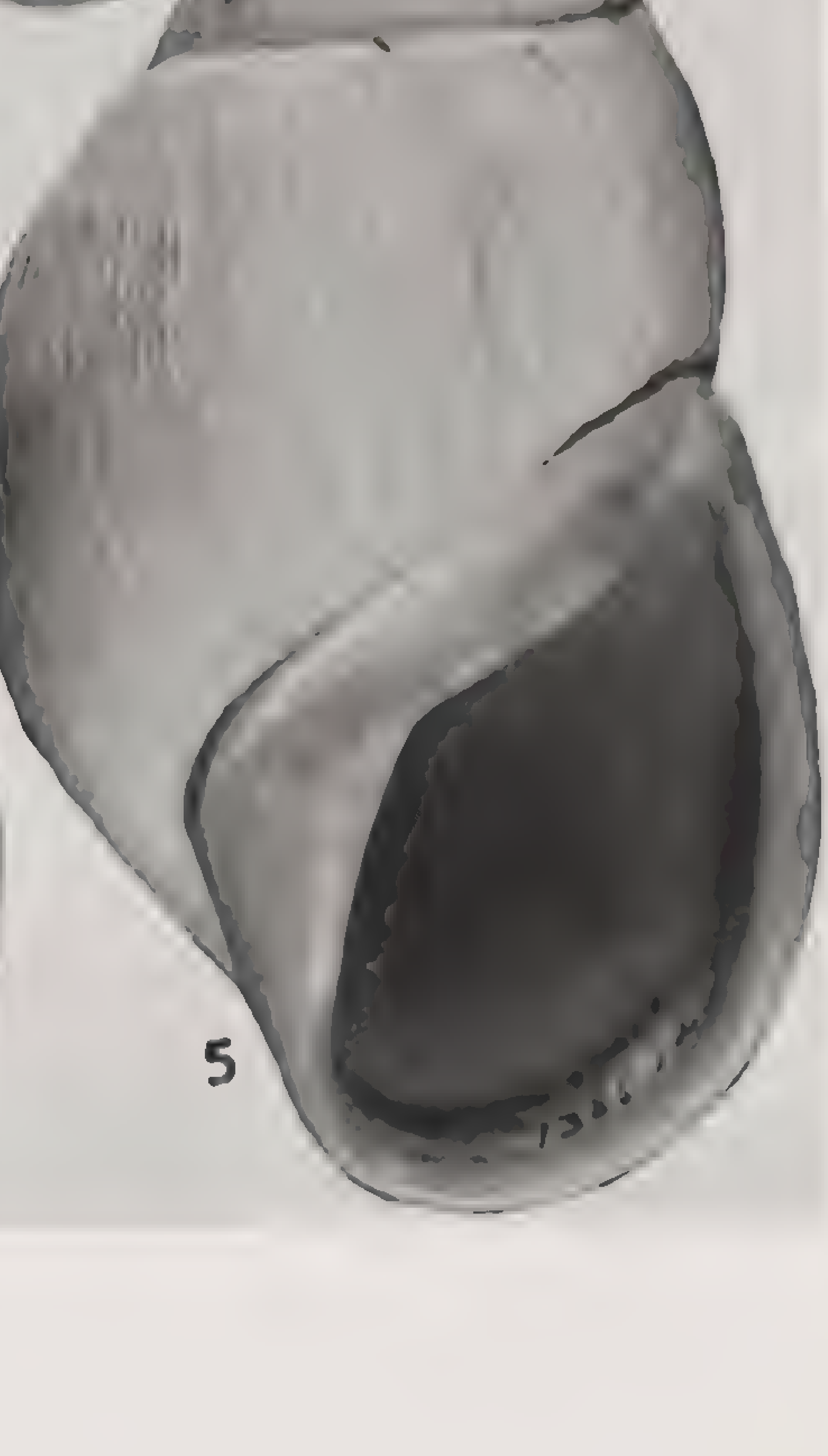

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PLATE 25

PLATE 25

Fig. 1. *Strophocheilus planidens* (Michelin). Brazil. Summit of young shell, X 5.

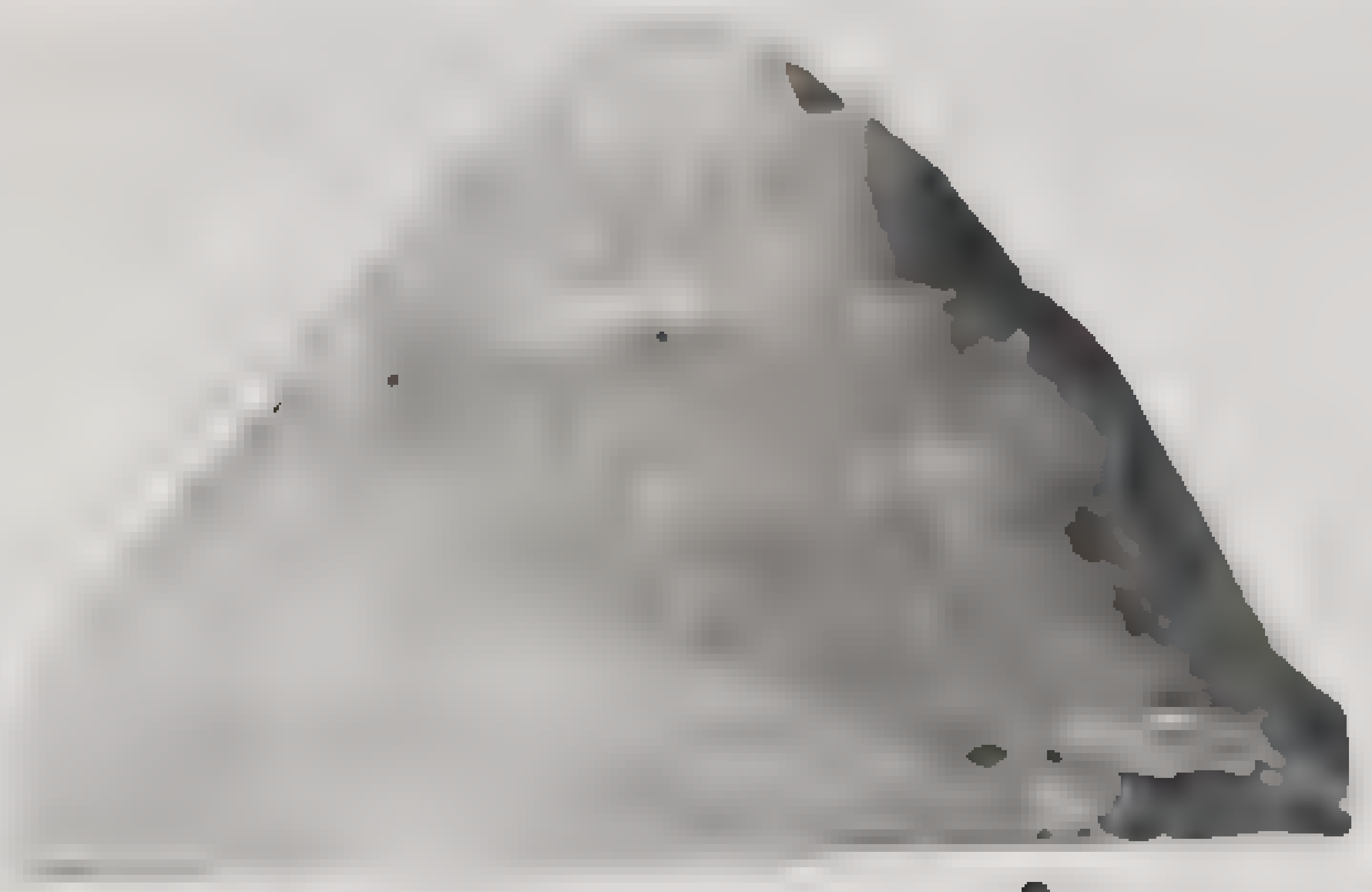
Fig. 2. *Strophocheilus planidens fusoides* J. Bequaert. Holotype. Taquara do Mundo Novo. M.C.Z. 75314.

Fig. 3. *Strophocheilus rosaceus* (King and Brodcrip). Valparaiso. M.C.Z. 87524.

Fig. 4. *Strophocheilus yporanganus toriii* (Lange de Morretes). Paratype. Jupuvura. M.C.Z. 179249.

Fig. 5. *Strophocheilus ovatus grandis* (v. Martens). Ilha São Sebastião. M.C.Z. 179225.

Natural Size, except Fig. 1.



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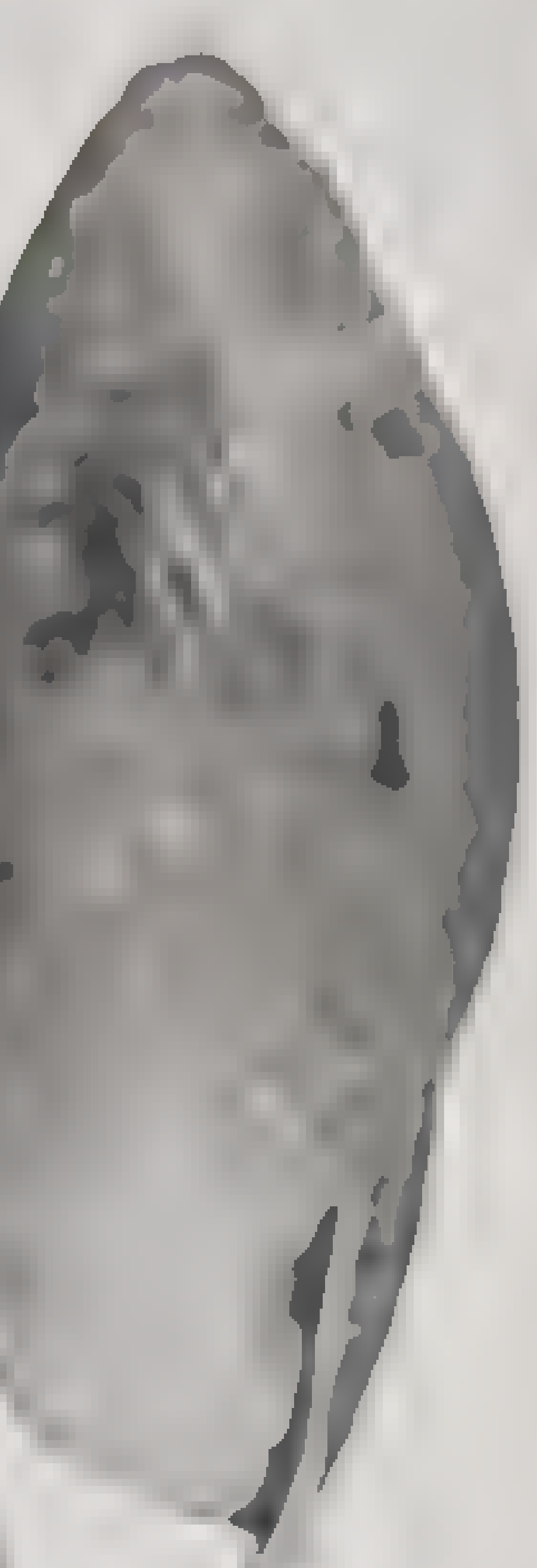

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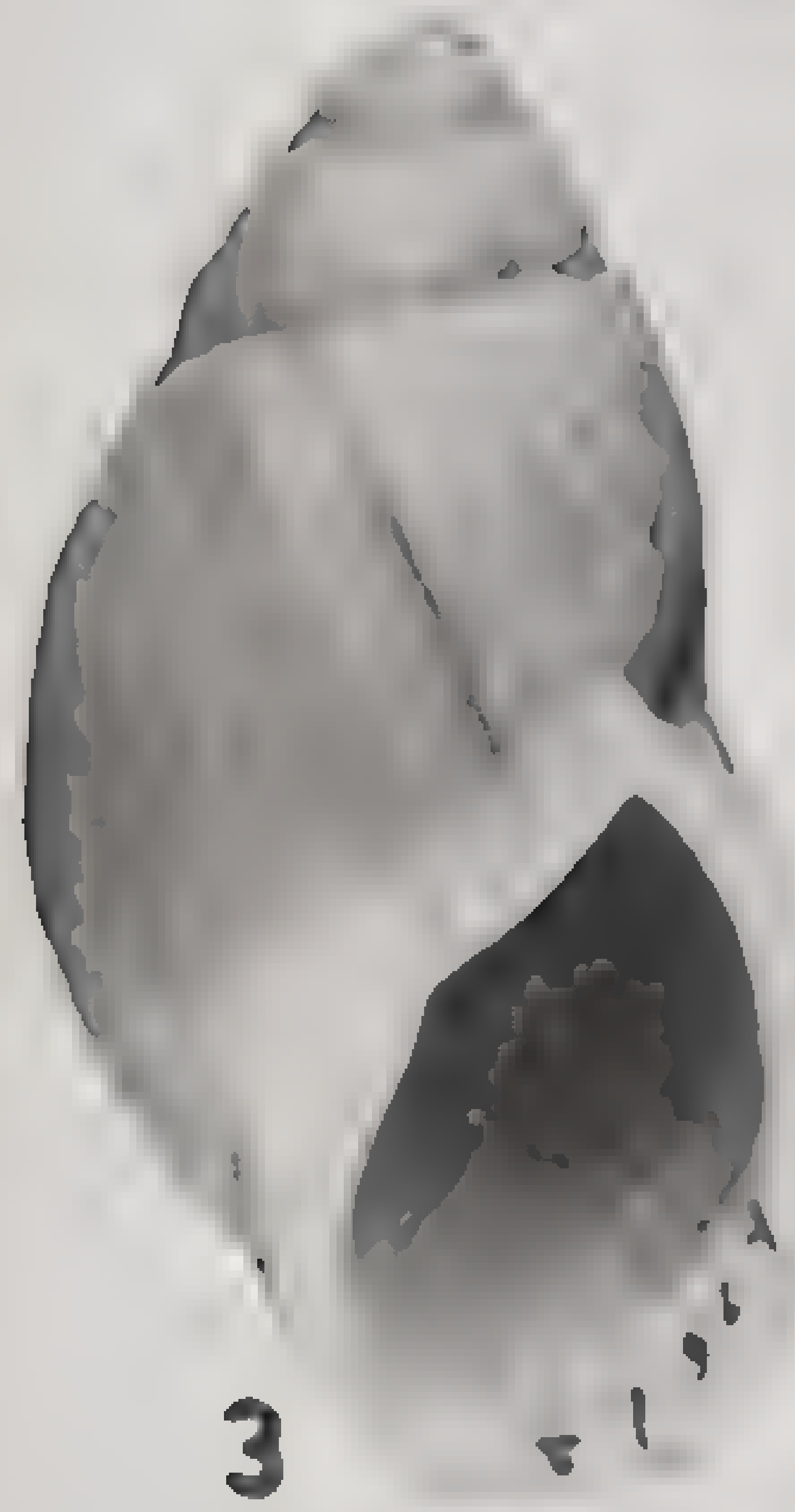

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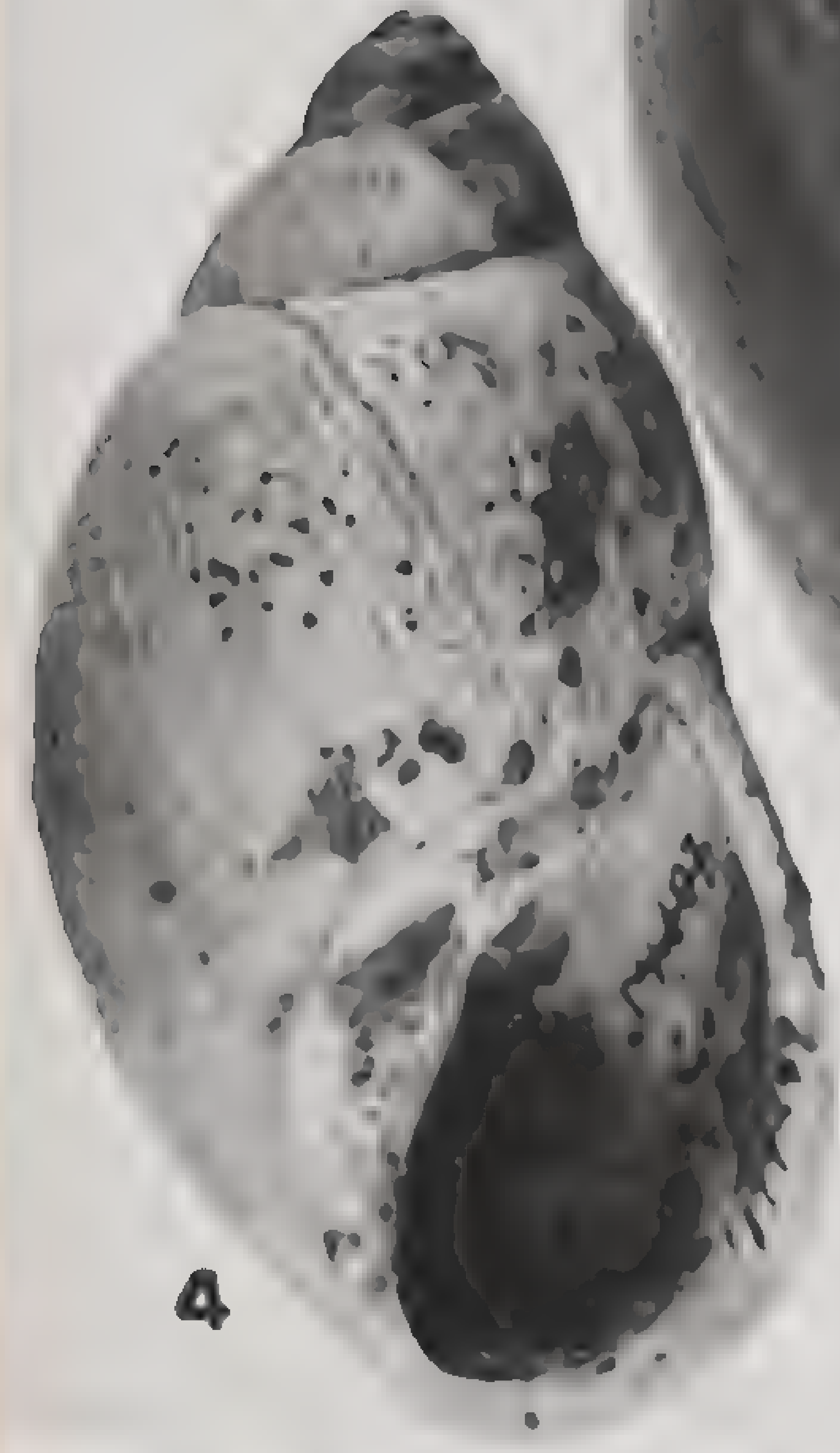

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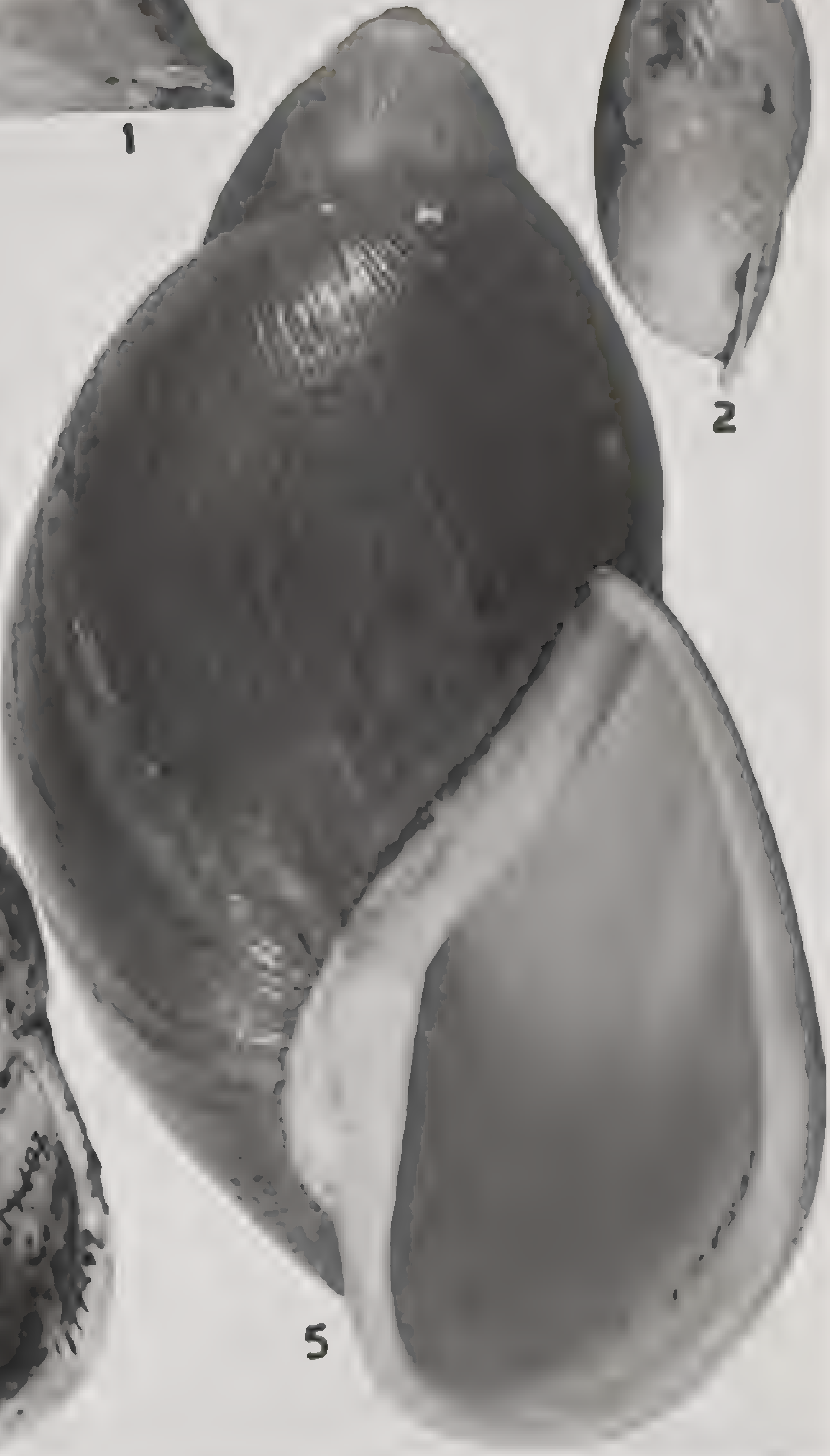

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PLATE 26

PLATE 26

Fig. 1. *Strophocheilus miersi* Da Costa. Copy of original figure of type.

Fig. 2. *Strophocheilus granulosus paranaguensis* Pilsbry and v. Ihering. Topotype. Paranaguá. U.S.N.M. 171460.

Fig. 3. *Strophocheilus auritus* (Sowerby). Rio de Janeiro. M.C.Z. 74398.

Fig. 4. *Gonyostomus turnix* (Gould). Piquete. M.C.Z. 179247.

Fig. 5. *Strophocheilus milleri iguapensis* Pilsbry. Campos de Jordão. M.C.Z. 179240.

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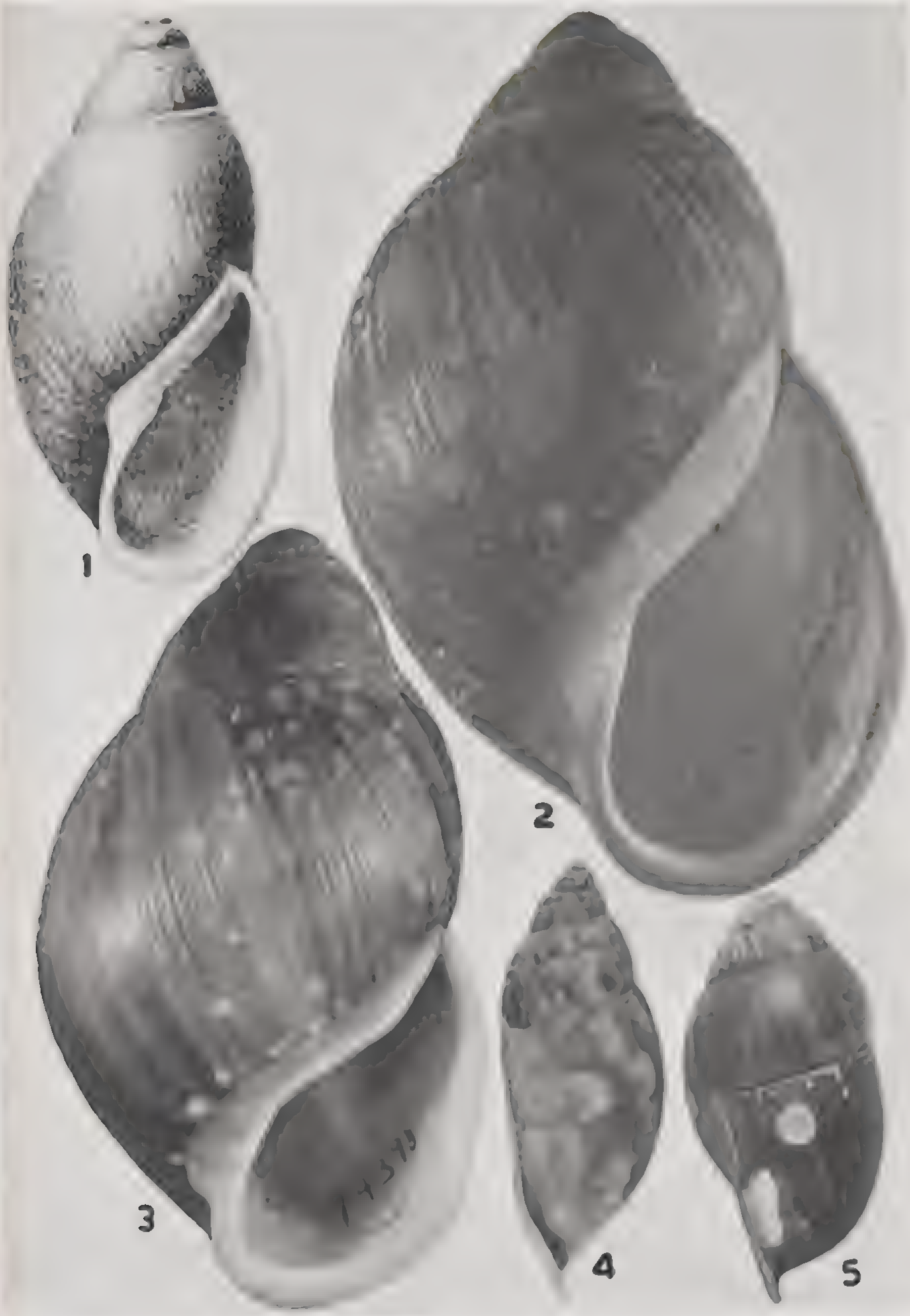
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PLATE 27

PLATE 27

Fig. 1. *Strophocheilus miersi* Da Costa. Espirito Santo. D.Z.S.P. 3234.

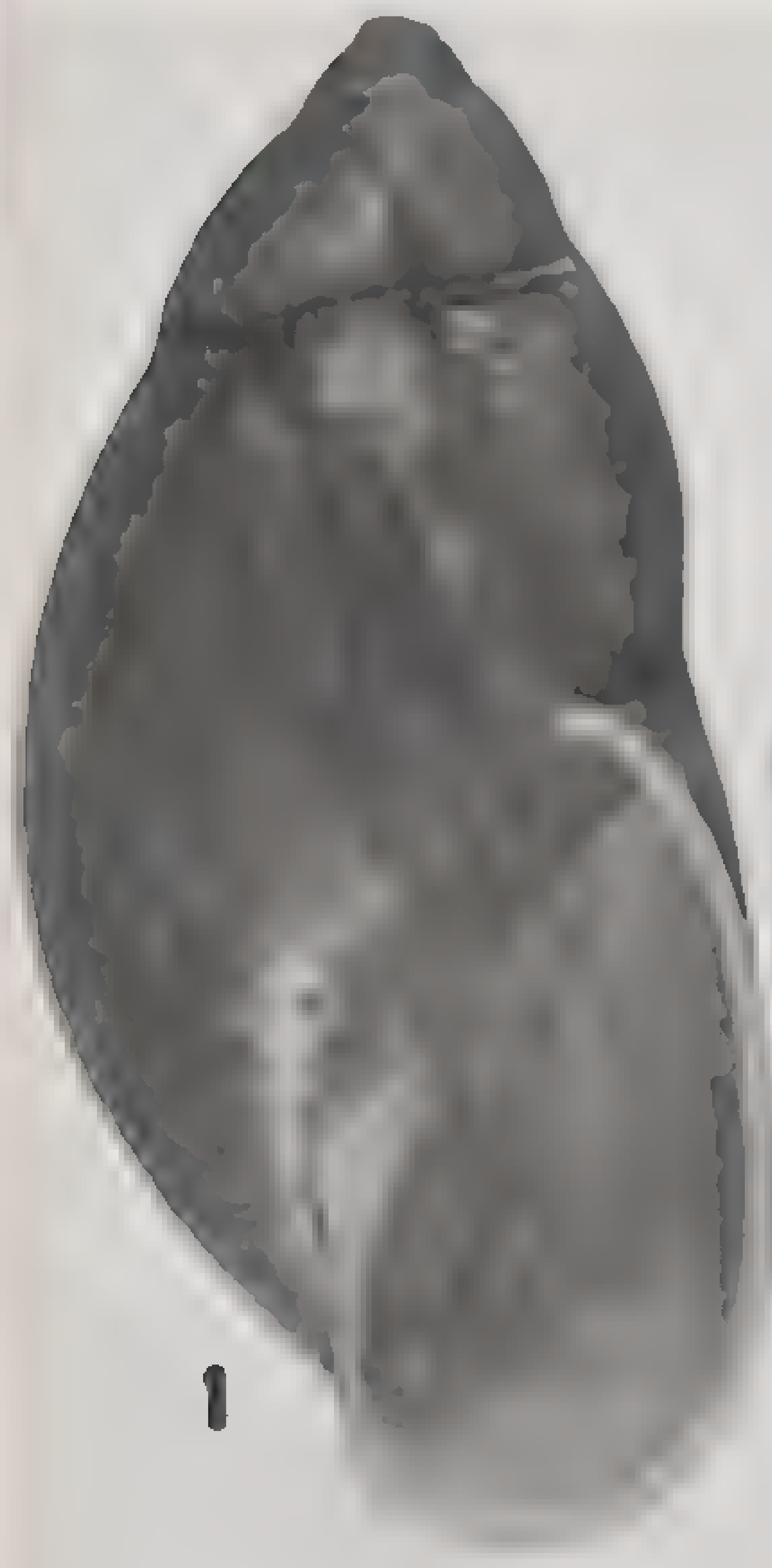
Fig. 2. *Strophocheilus lutescens* (King and Broderip). Montevideo. M.C.Z. 147594. Summit of adult shell, X 10.

Fig. 3. *Strophocheilus lutescens* (King and Broderip). Montevideo. M.C.Z. 179246.

Fig. 4. *Strophocheilus granulosus abbreviatus* J. Bequaert. Holotype. Brazil. M.C.Z. 49537.

Fig. 5. *Strophocheilus oblongus lorentzianus* (Döring). Jujuy. M.C.Z. 132303.

Natural Size, except Fig. 2.



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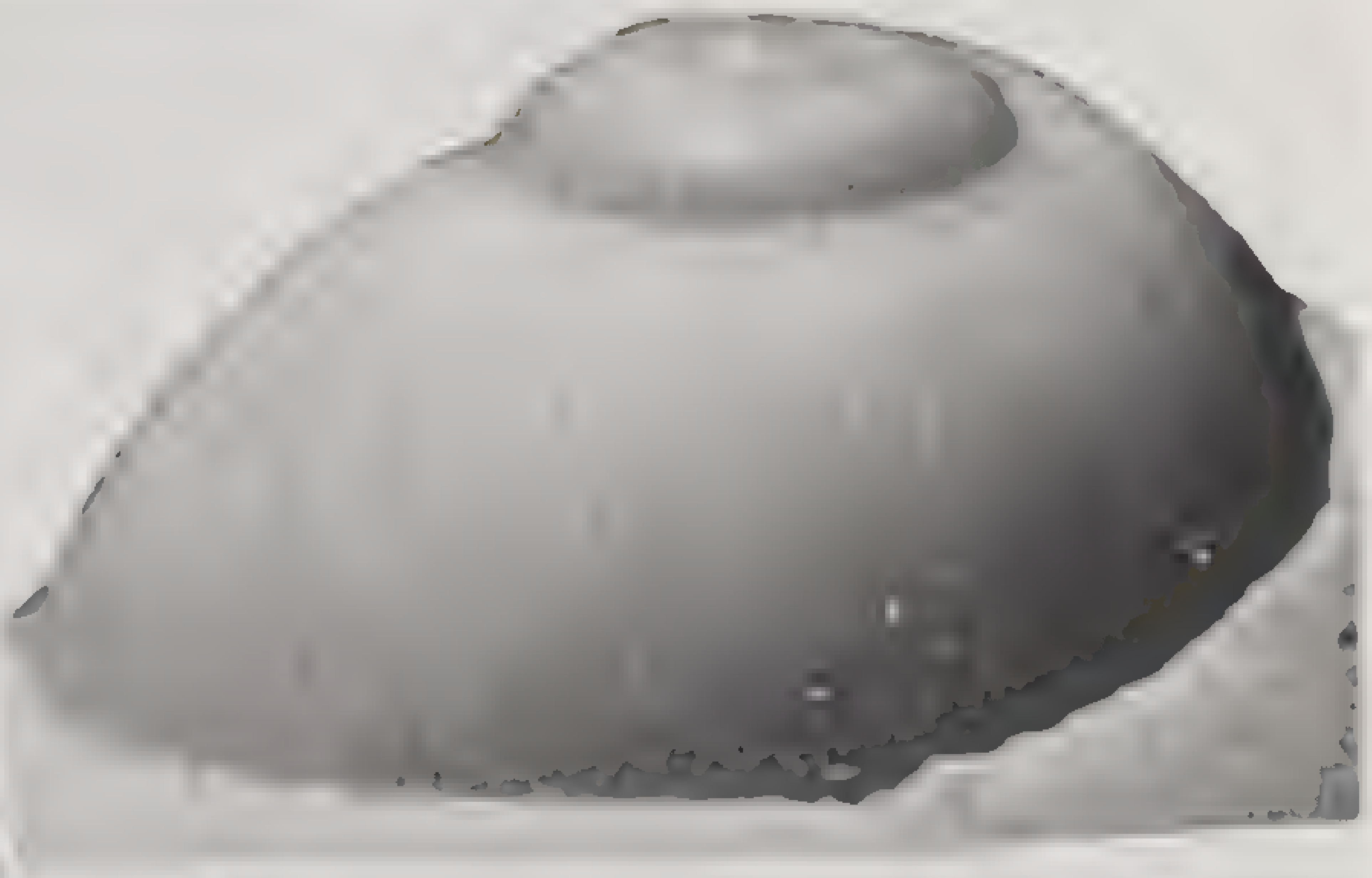

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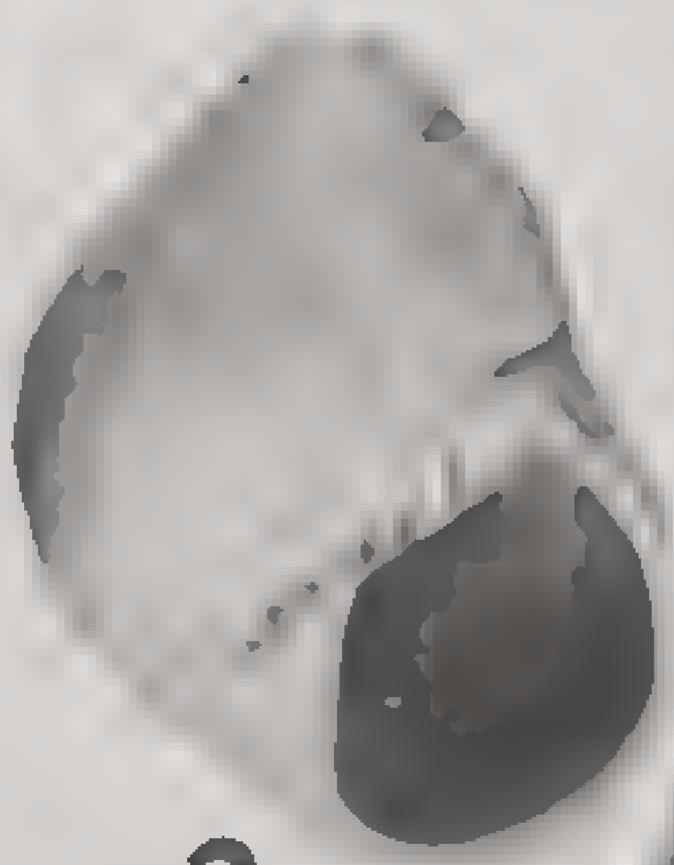

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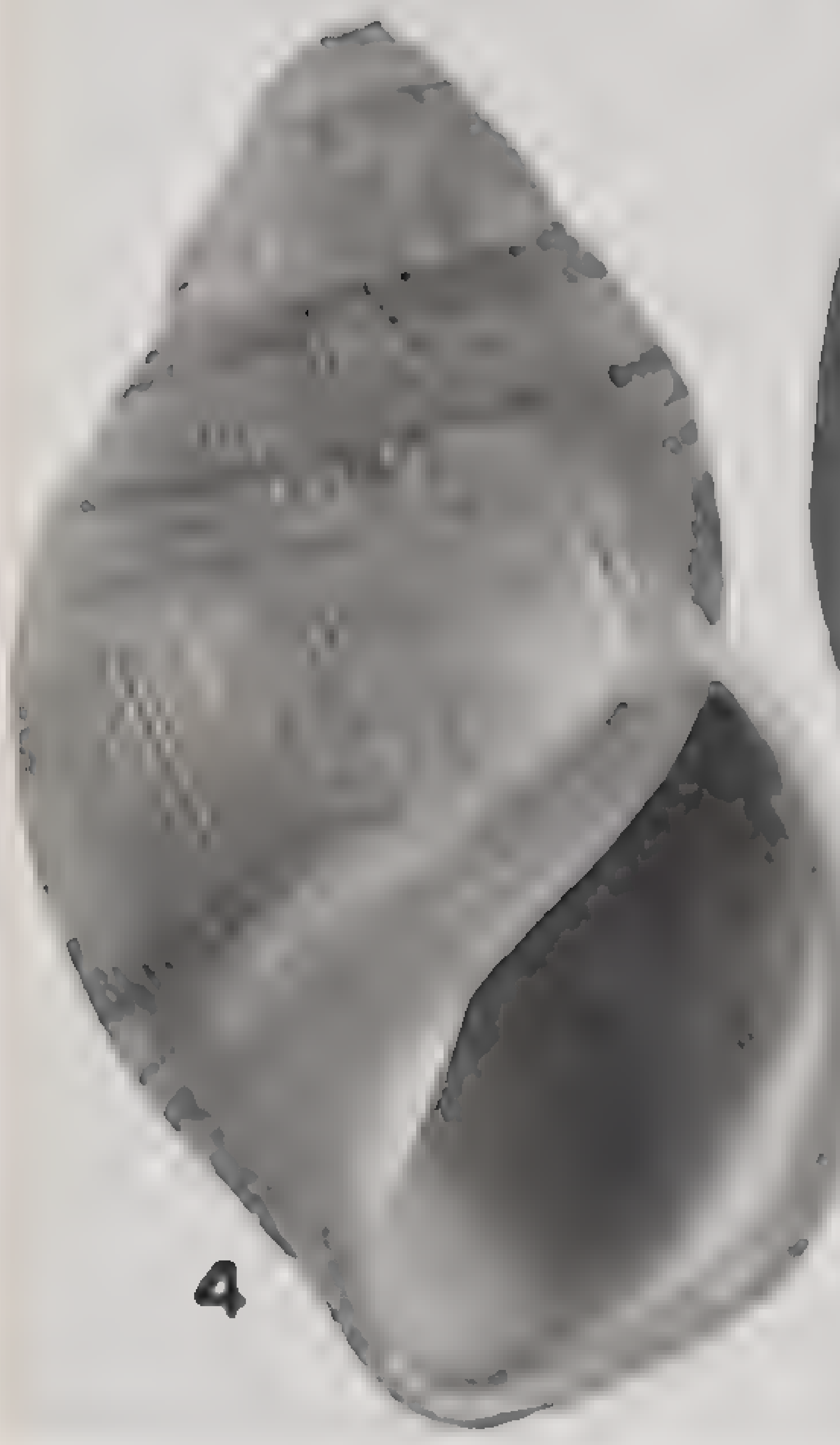

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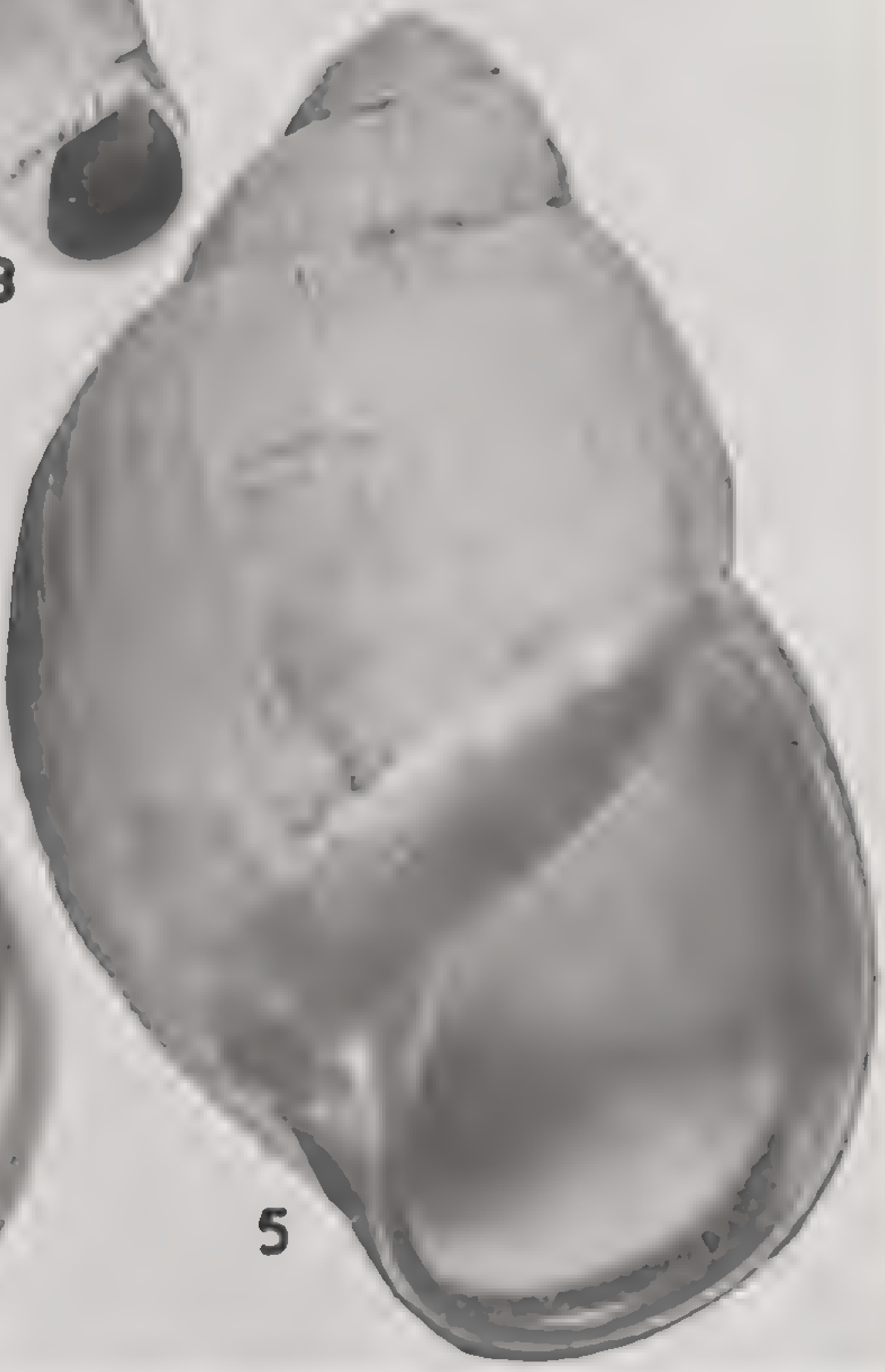

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PLATE 28

PLATE 28

Fig. 1. *Strophocheilus oblongus* (O. F. Müller). Barbados. M.C.Z. 90359. Summit of young shell, X 5.

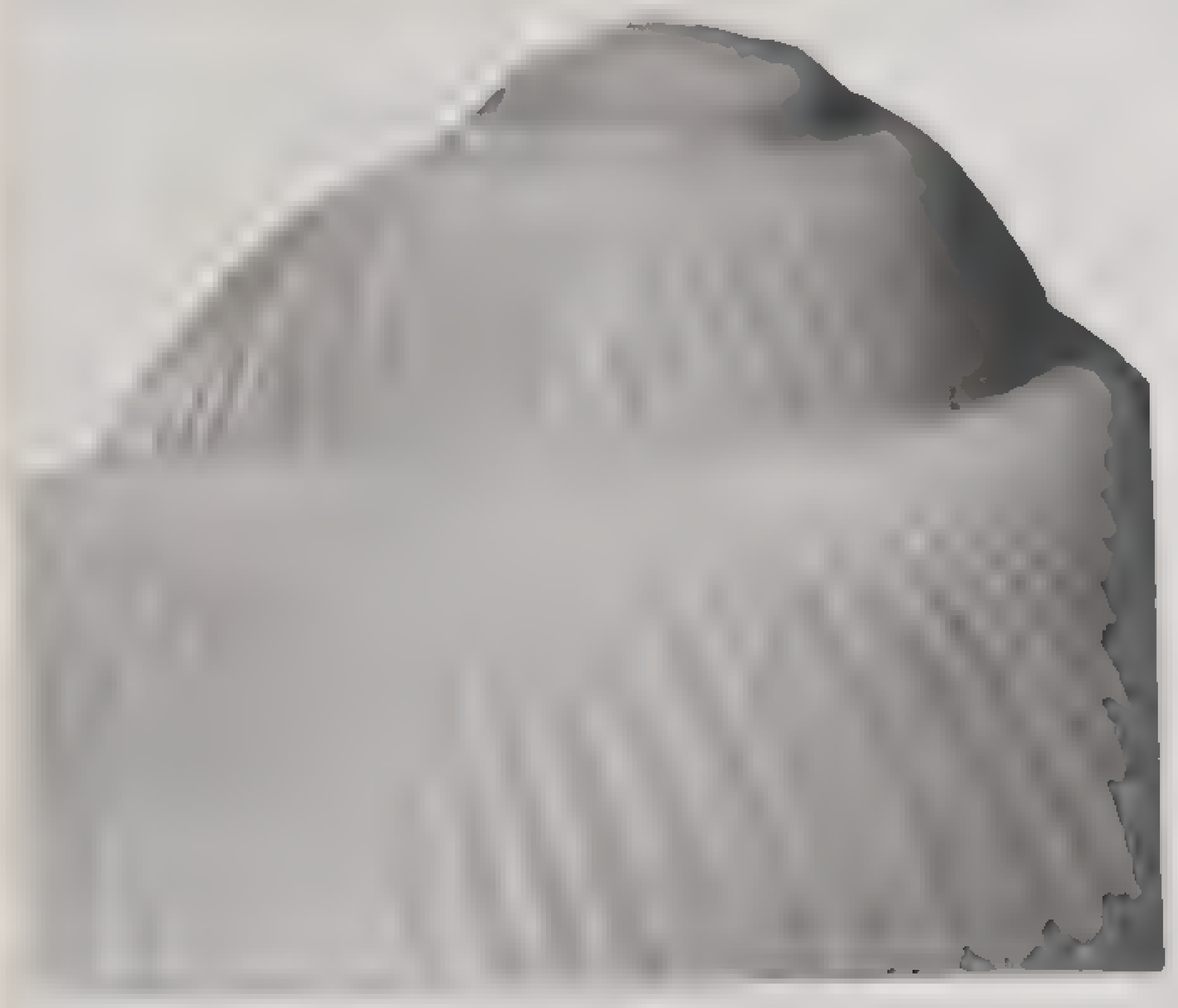
Fig. 2. *Strophocheilus proclivis* (v. Martens). Topotype. Taquara do Mundo Novo. M.N.H.Chic. 27570.

Fig. 3. *Strophocheilus granulosus foreli* J. Bequaert. Holotype. Punta Grossa. D.Z.S.P. 7984.

Fig. 4. *Gonyostomus egregius* (Pfeiffer). Brazil. M.C.Z.

Fig. 5. *Gonyostomus goniostoma* (Férussac). Brazil. M.C.Z. Summit of adult shell, X 5.

Natural Size, except Figs. 1 and 5.



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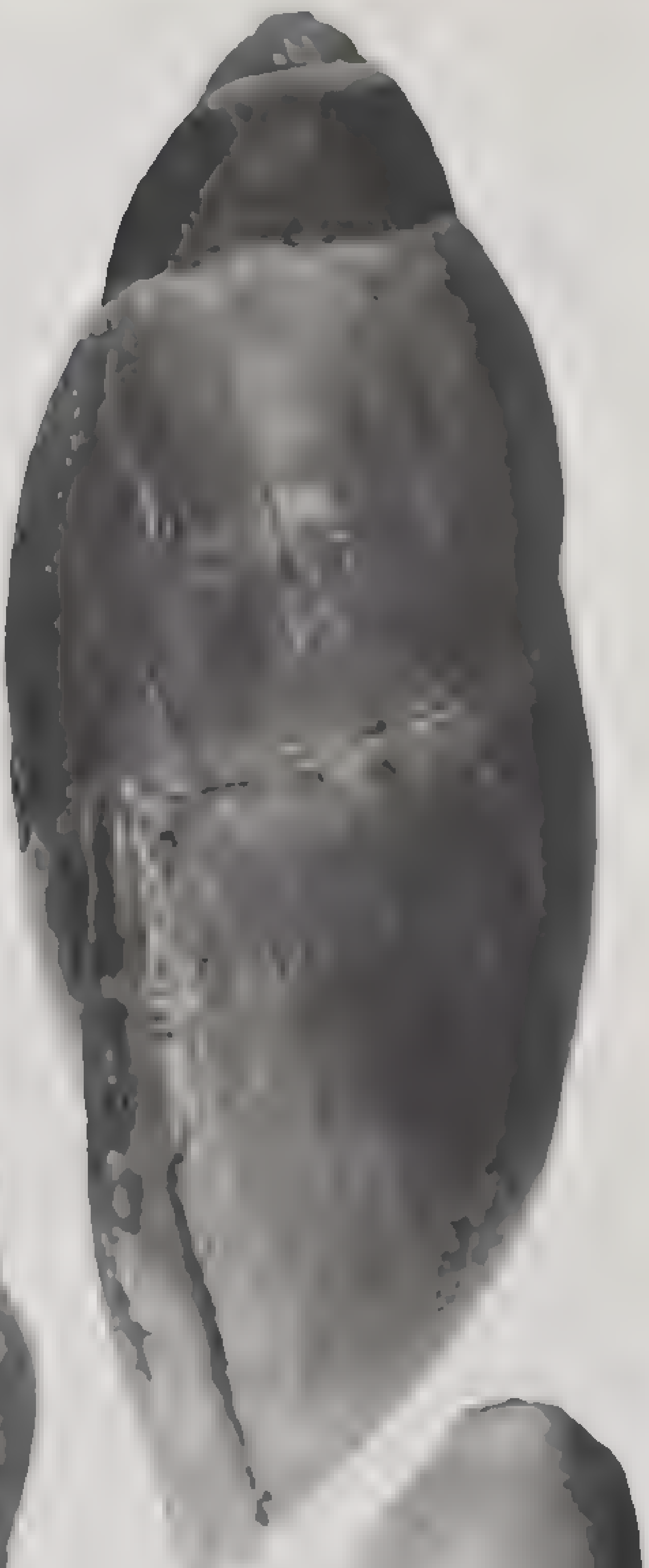

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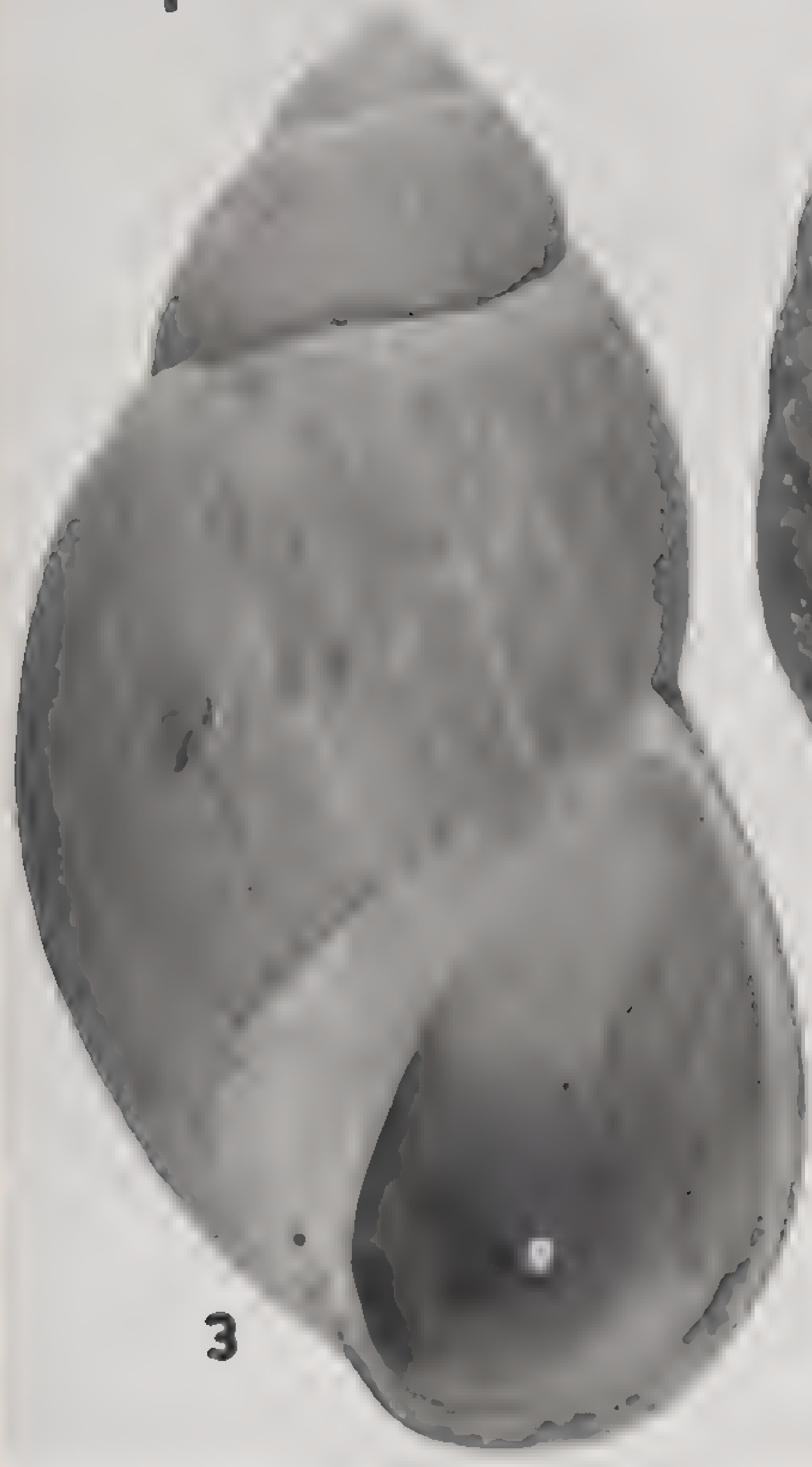

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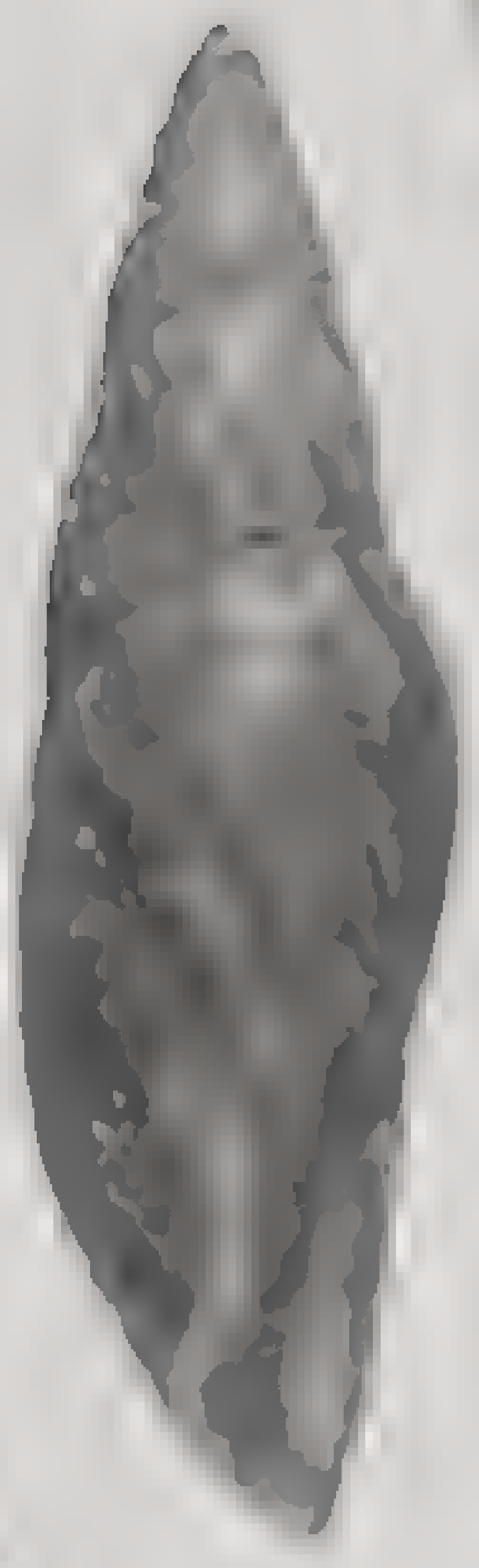

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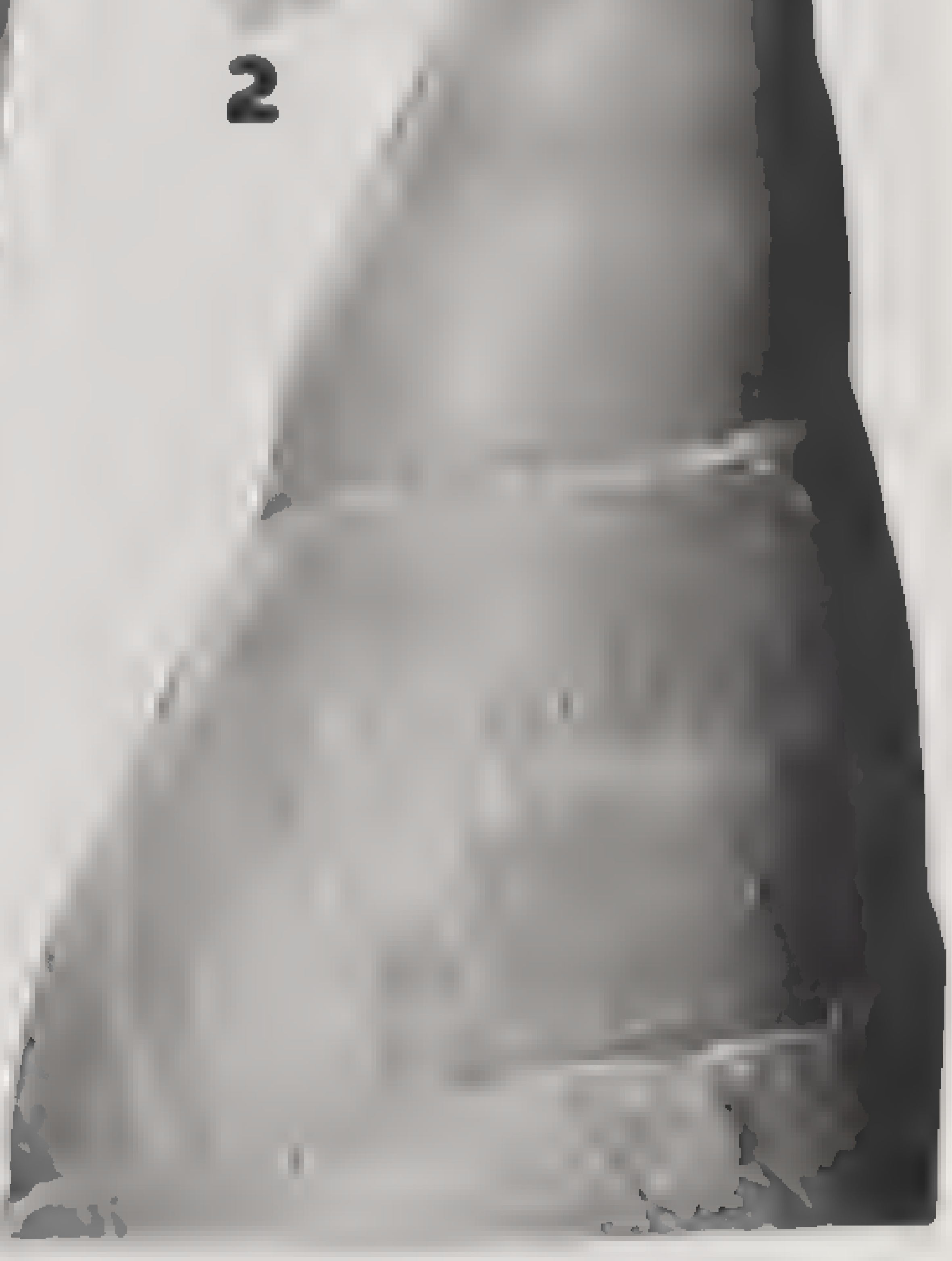

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PLATE 29

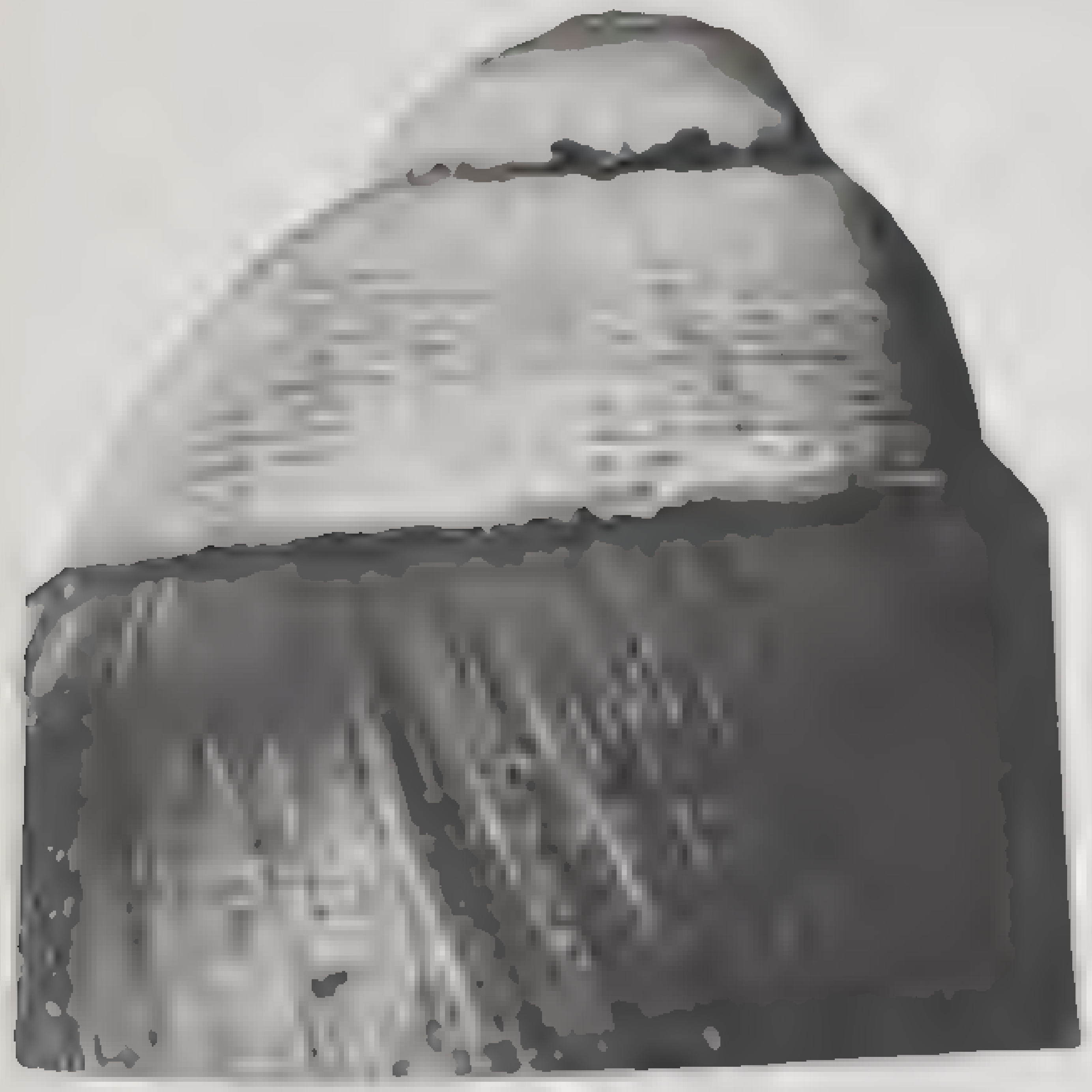
PLATE 29

Fig. 1. *Strophocheilus pilsbryi* v. Ihering. Rio de Janeiro. M.C.Z. 75747. Summit of adult shell, X 5.

Fig. 2. *Strophocheilus rosaceus* (King and Broderip). Valparaiso. M.C.Z. 87524. Summit of adult shell, X 5.

Fig. 3. *Strophocheilus maximus huascari* (v. Tschudi). Chanchamayo. M.C.Z. 124831.

Fig. 4. *Strophocheilus granulosus* (Rang). Colonia Hansa. D.Z.S.P. 3245.
Natural Size, except Figs. 1 and 2.



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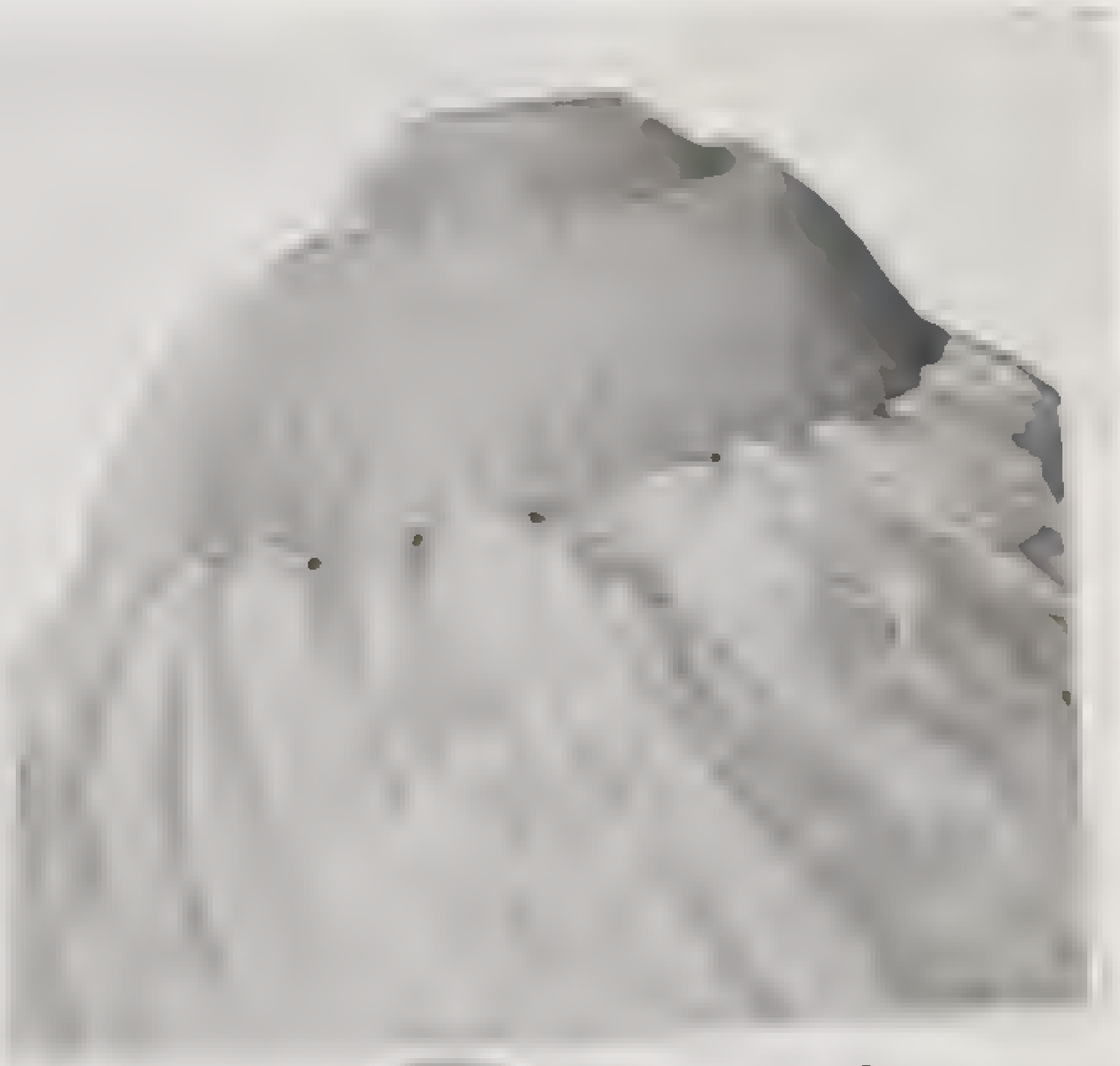

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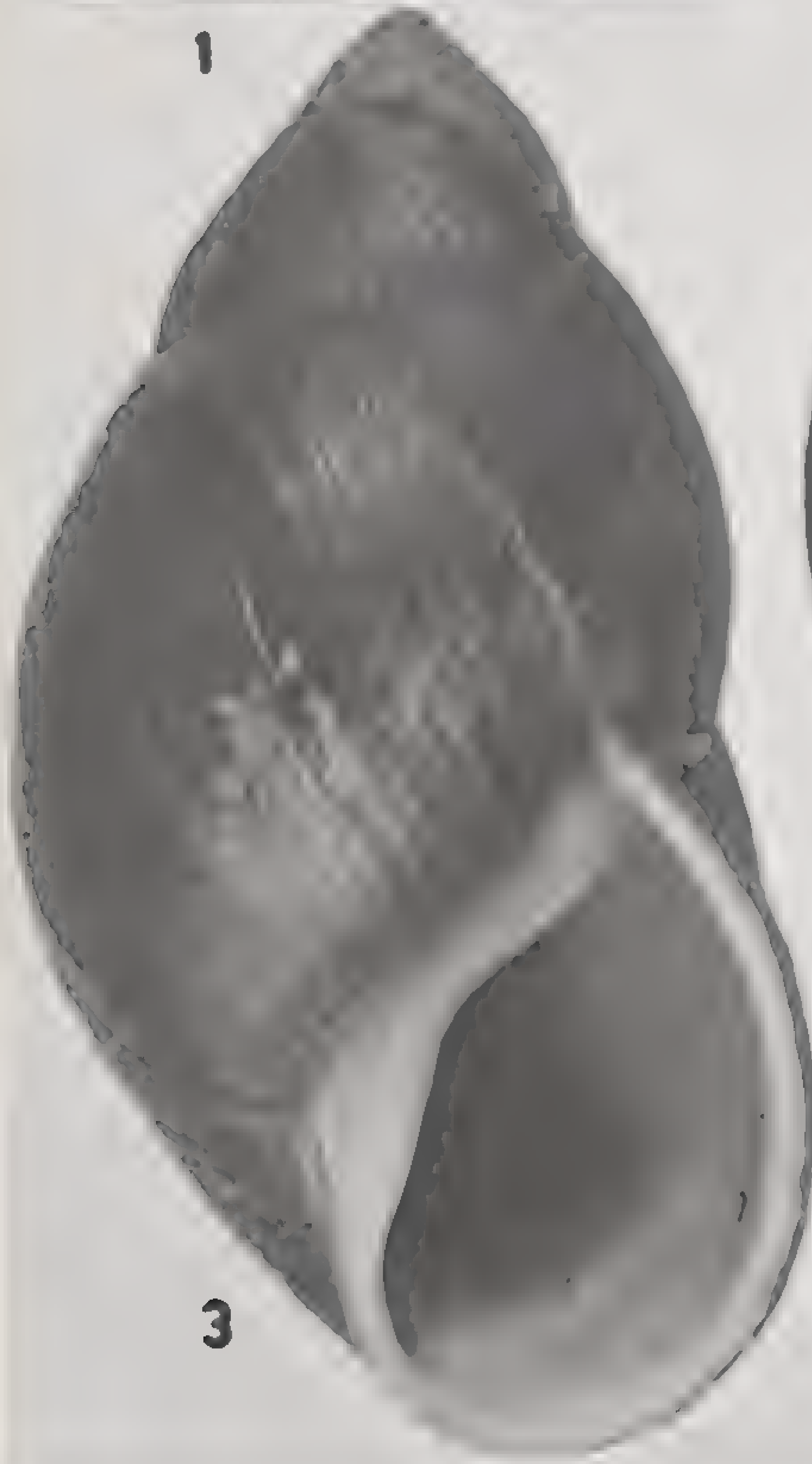

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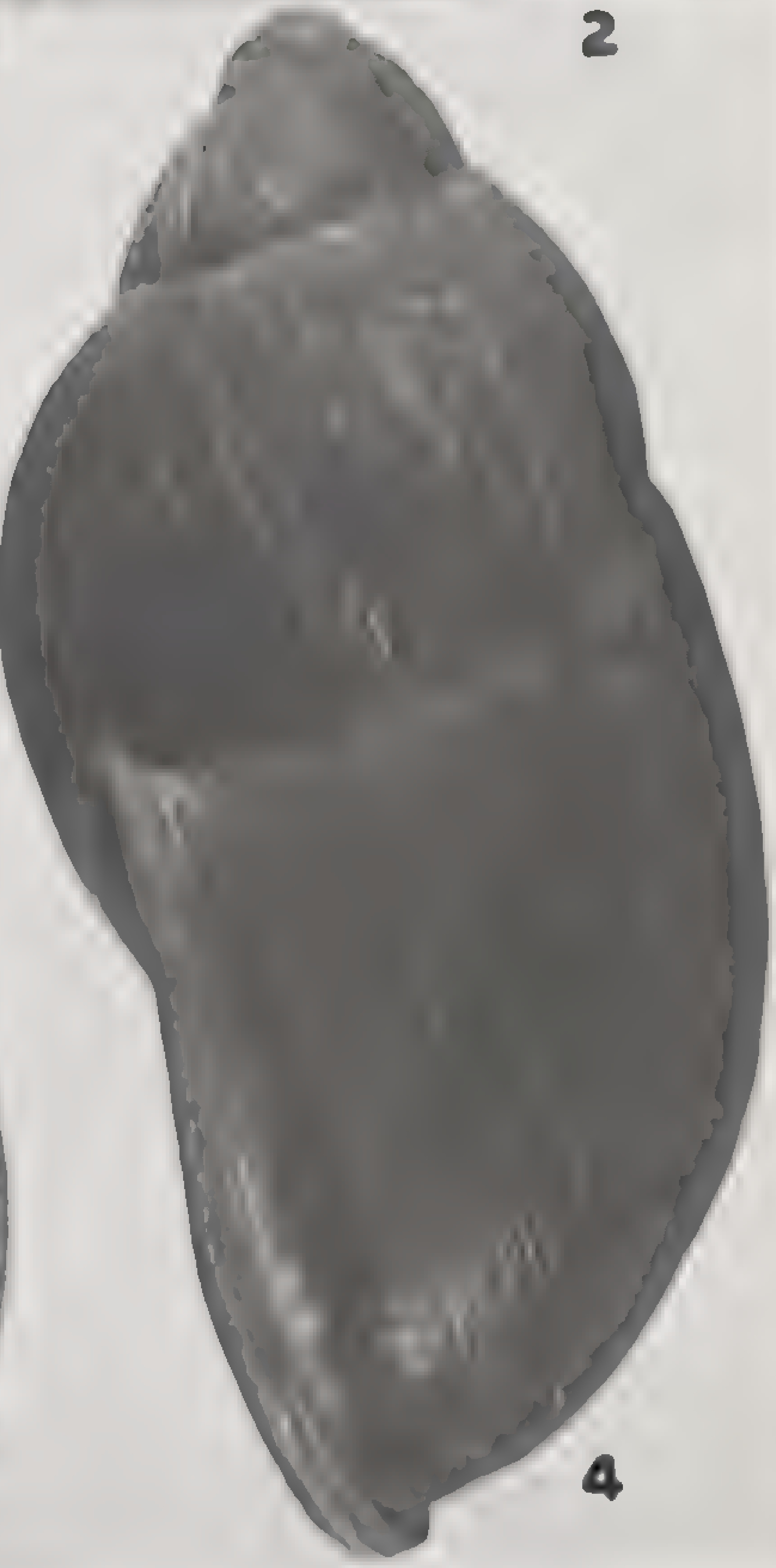

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PLATE 30

PLATE 30

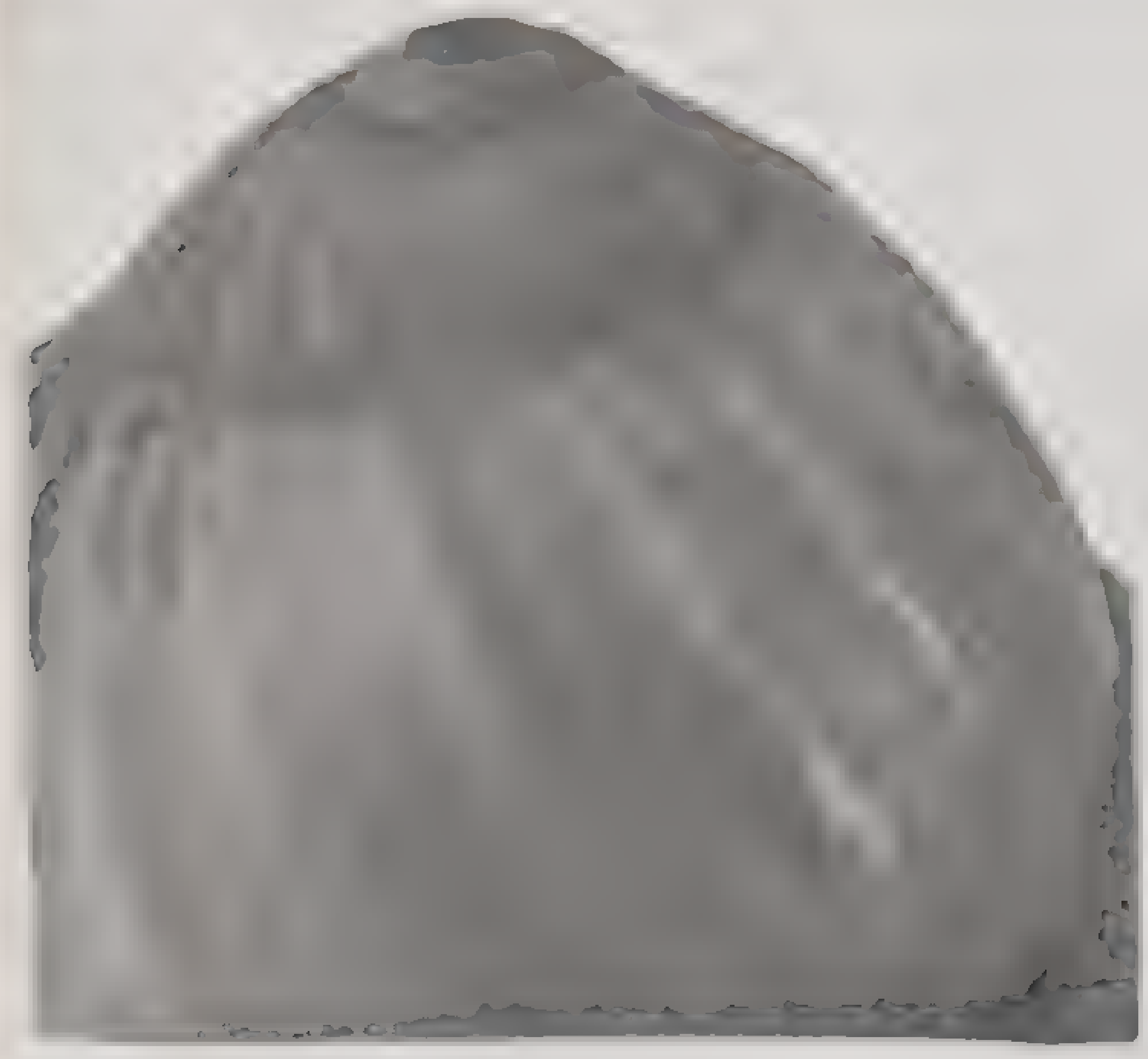
Fig. 1. *Strophocheilus ovatus grandis* (v. Martens). Ilha São Sebastião. M.U.Mich. 36281. Summit of adult shell, X 3.

Fig. 2. *Strophocheilus carrikeri* Pilsbry. Pan de Azucar. M.C.Z. 150828. Summit of young shell, X 2.

Fig. 3. *Strophocheilus santa-cruzii* (d'Orbigny). Possible cotype. Bolivia. U.S.N.M. 104908.

Fig. 4. *Strophocheilus granulosus paranaguensis* Pilsbry and v. Ihering. Iguapé. M.C.Z. 179239.

Natural Size, except Figs. 1 and 2.



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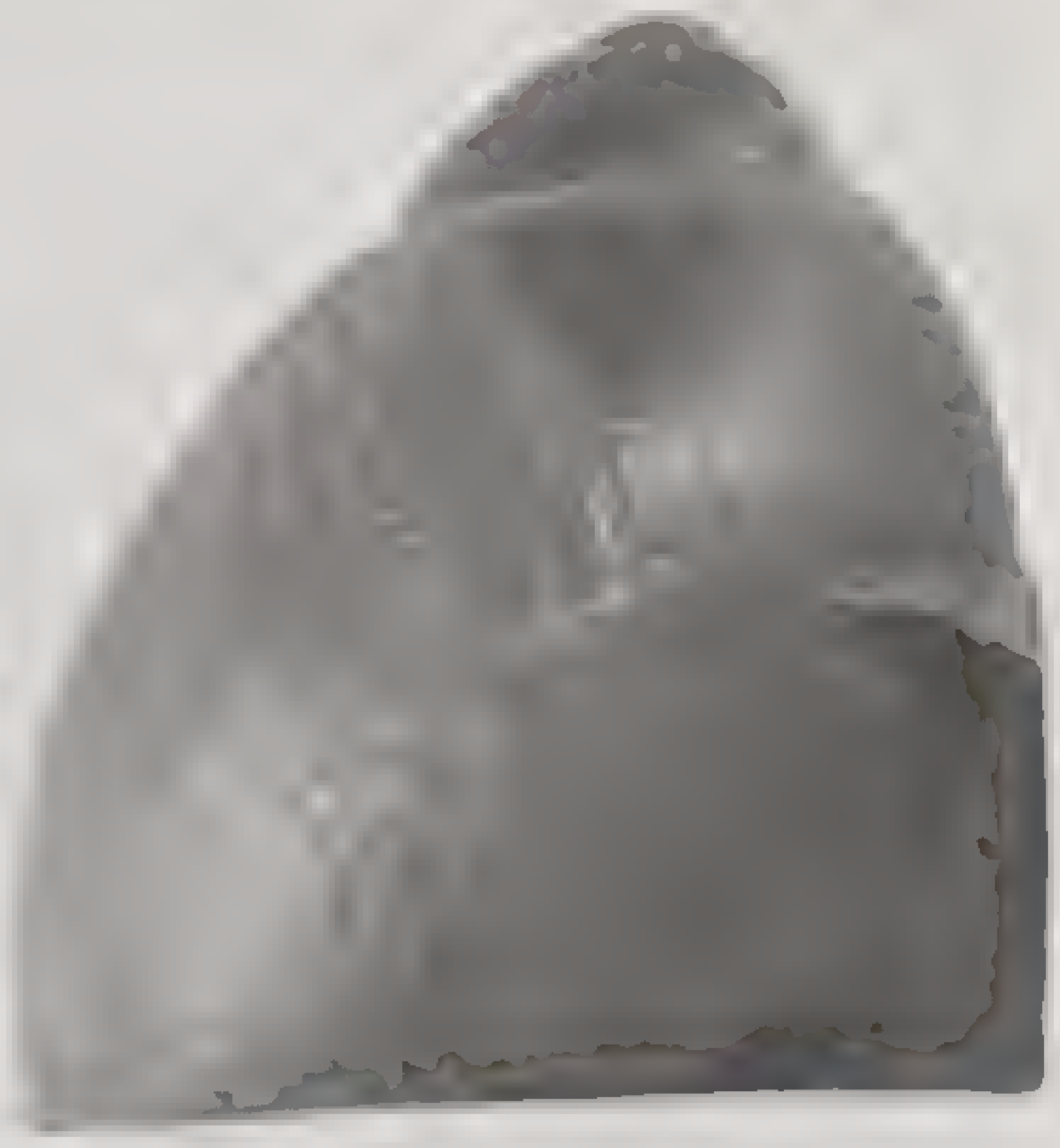

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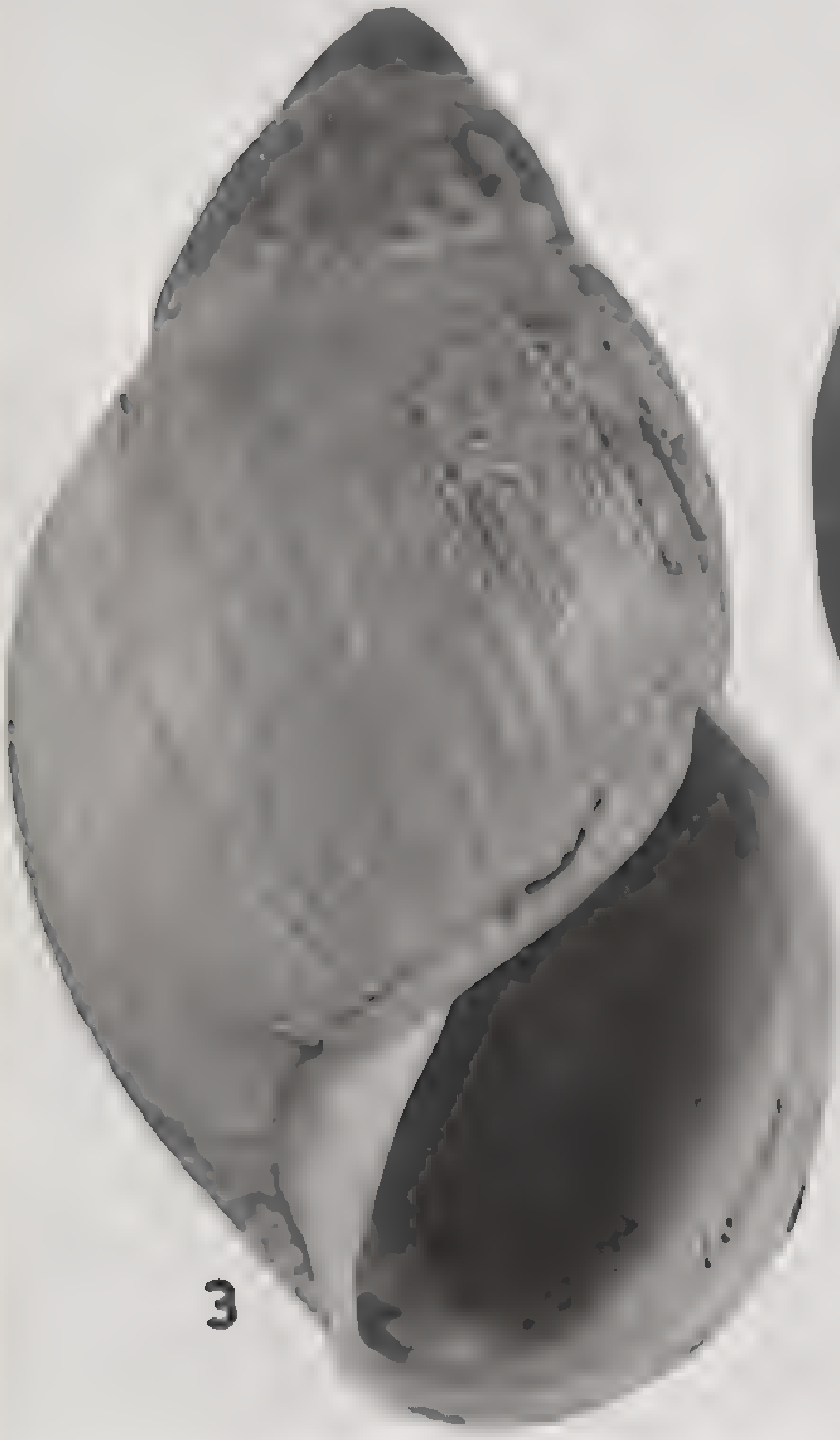

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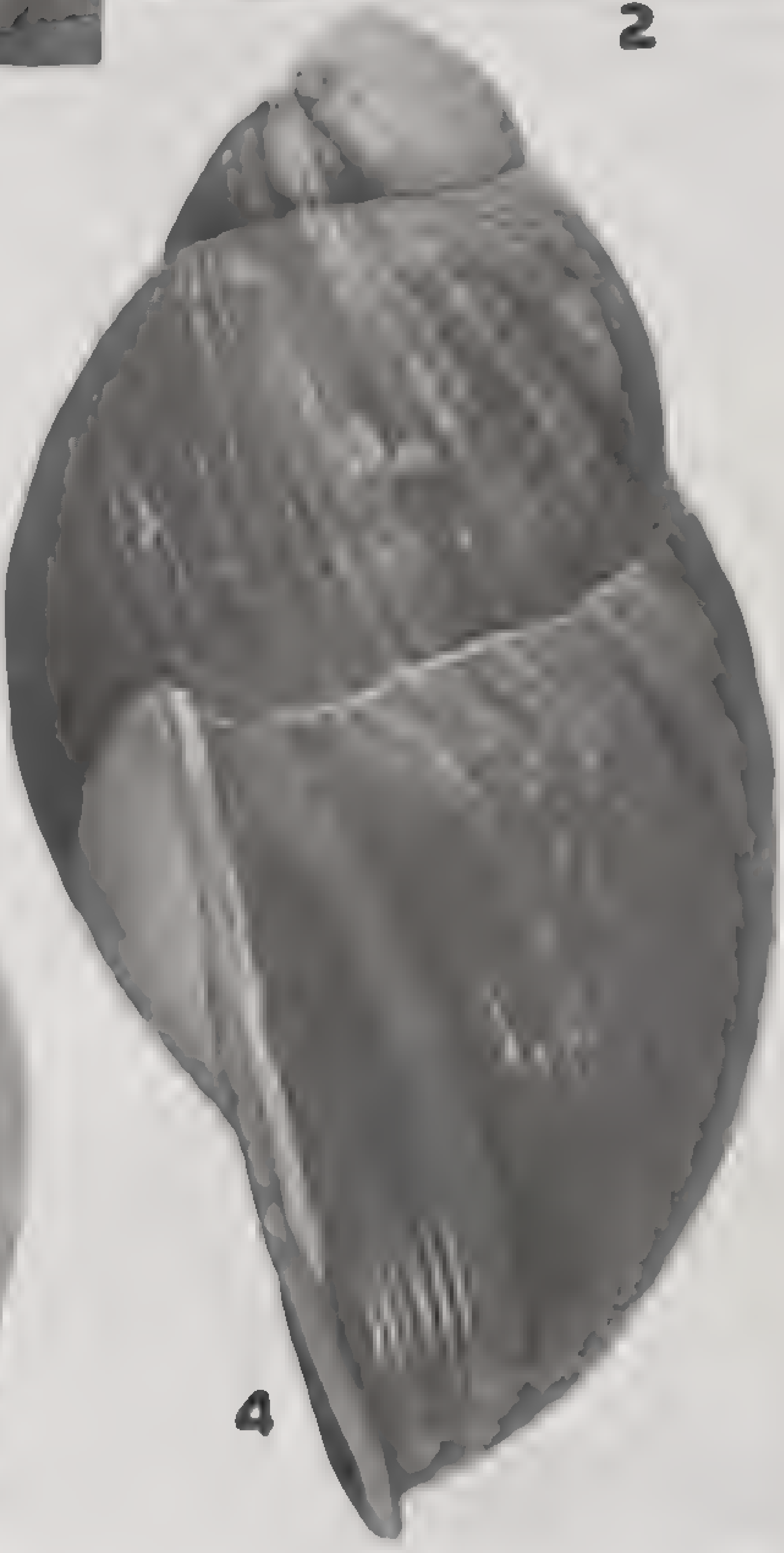

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PLATE 31

PLATE 31

Figs. 1 and 6. *Strophocheilus rosaceus seneri* (Jousseaume). Holotype. Paris Museum. Courtesy of Dr. E. Fischer.

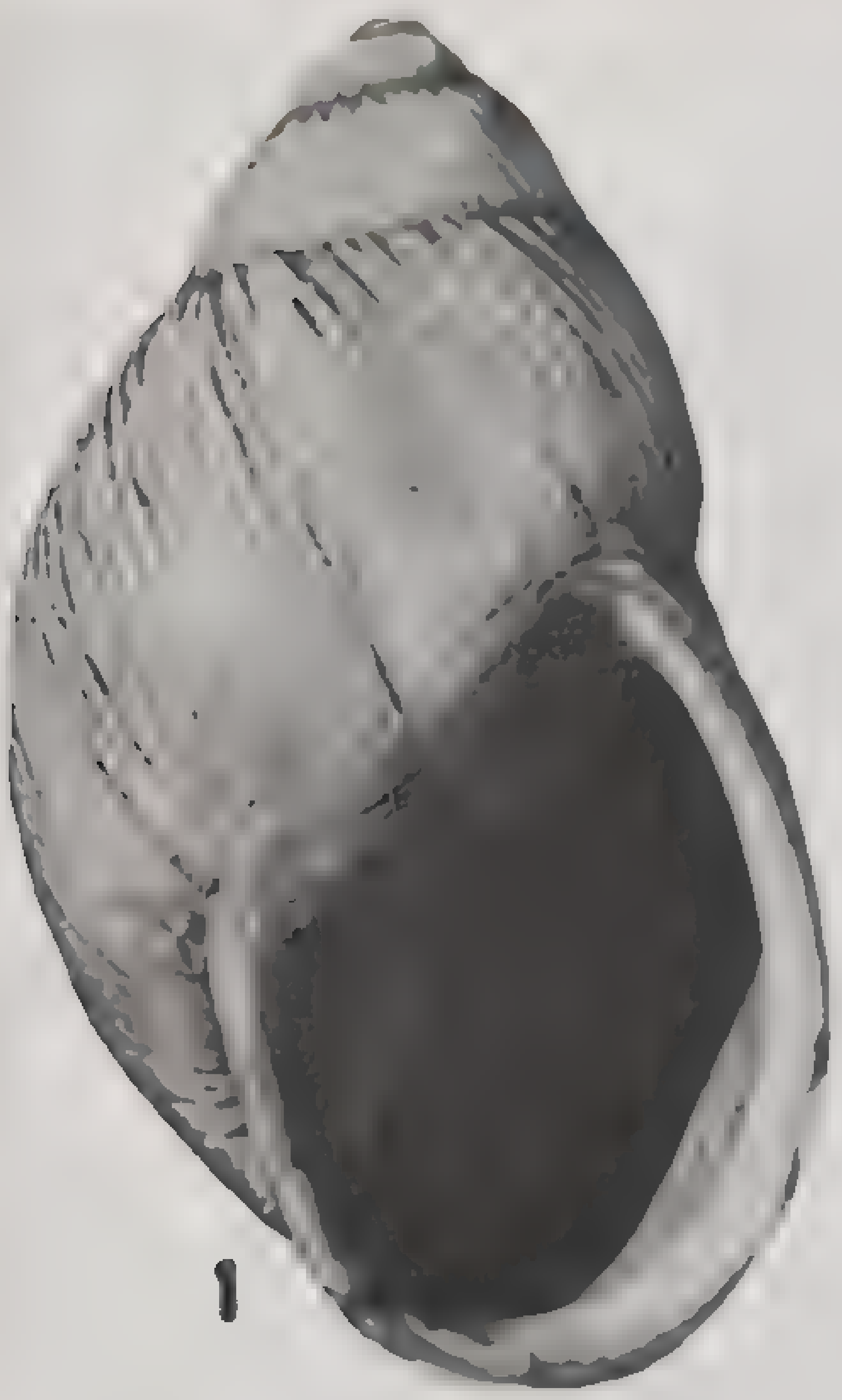
Fig. 2. *Strophocheilus leucostoma* (Sowerby). Holotype of *Bulimus castelnaudi* Hupé. Peru. Paris Museum. Courtesy of Dr. E. Fischer.

Fig. 3. *Strophocheilus miersi* Da Costa. Espírito Santo. D.Z.S.P. No. 3234.

Fig. 4. *Strophocheilus oblongus musculus* J. Bequaert. Holotype. Villarrica. M.C.Z. No. 62471.

Fig. 5. *Strophocheilus milleri* (Sowerby). Bahia. M.C.Z.

All Natural Size.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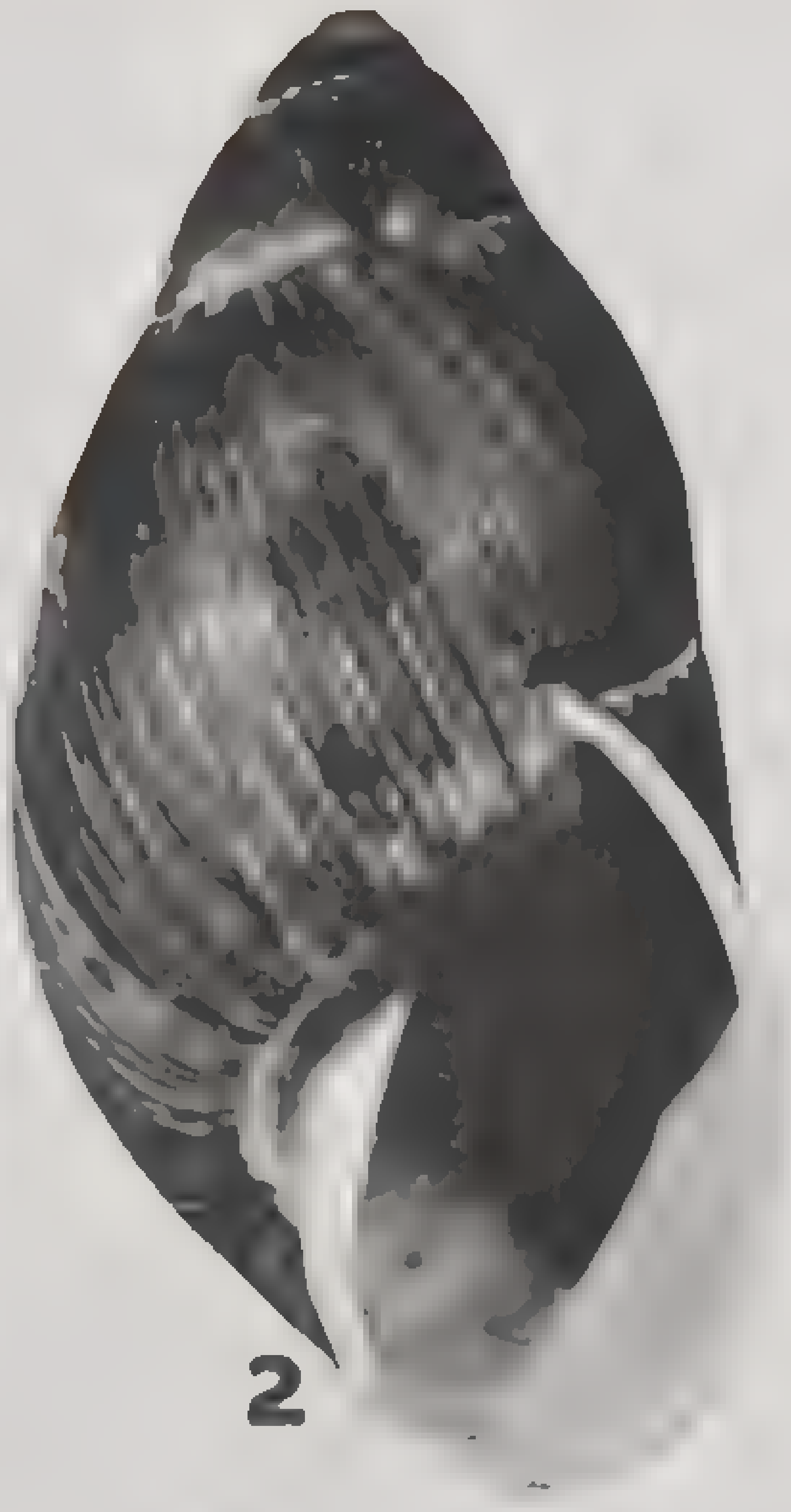
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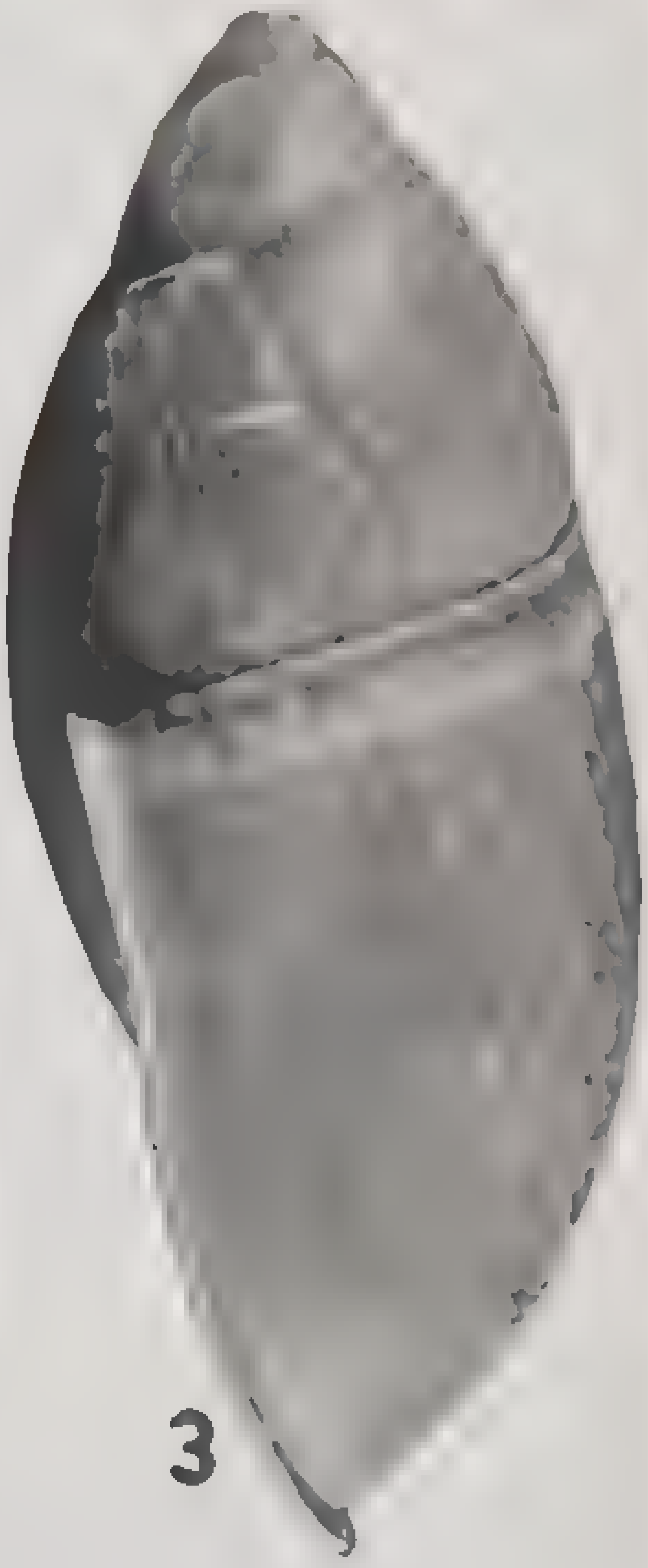
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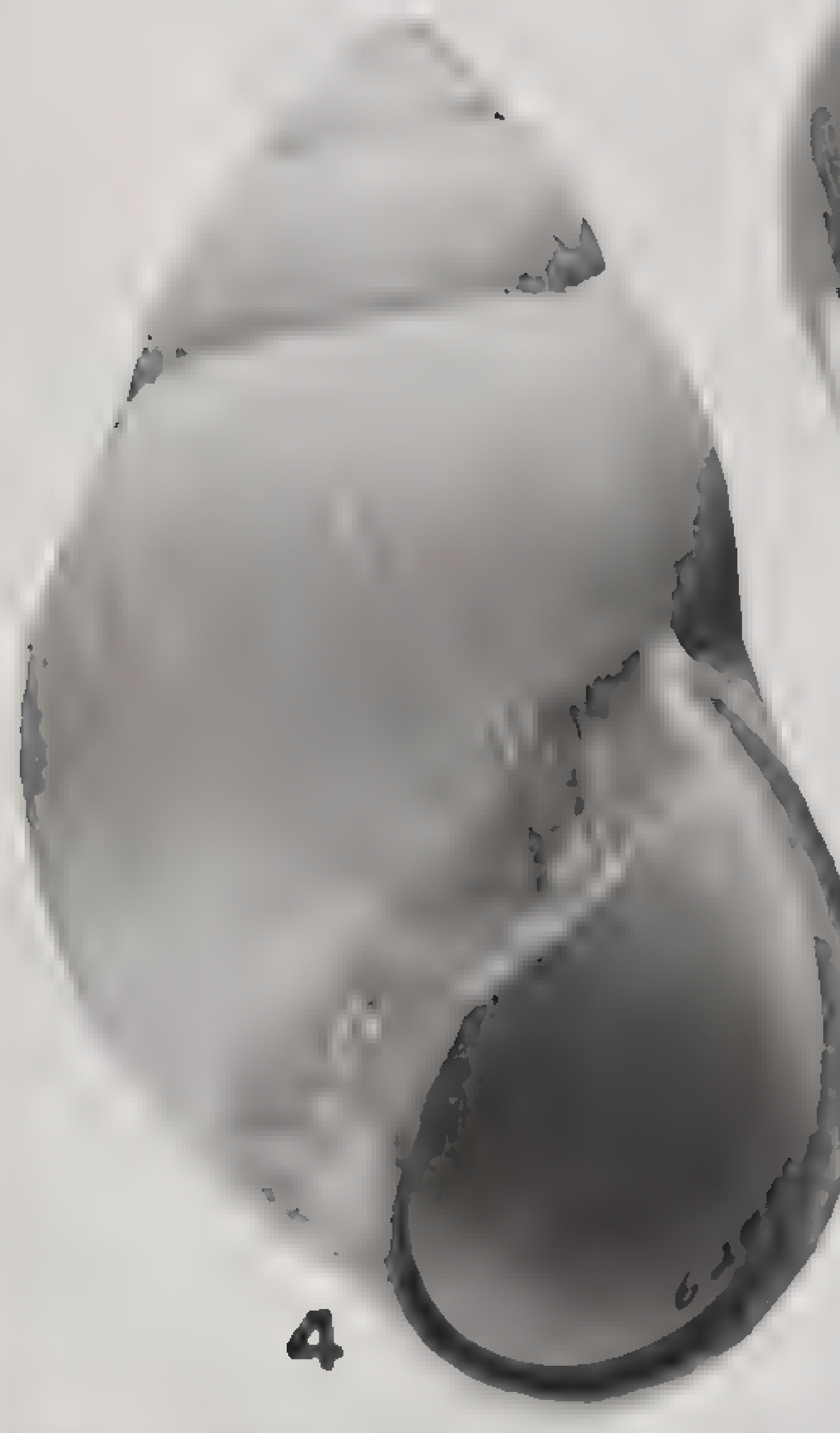
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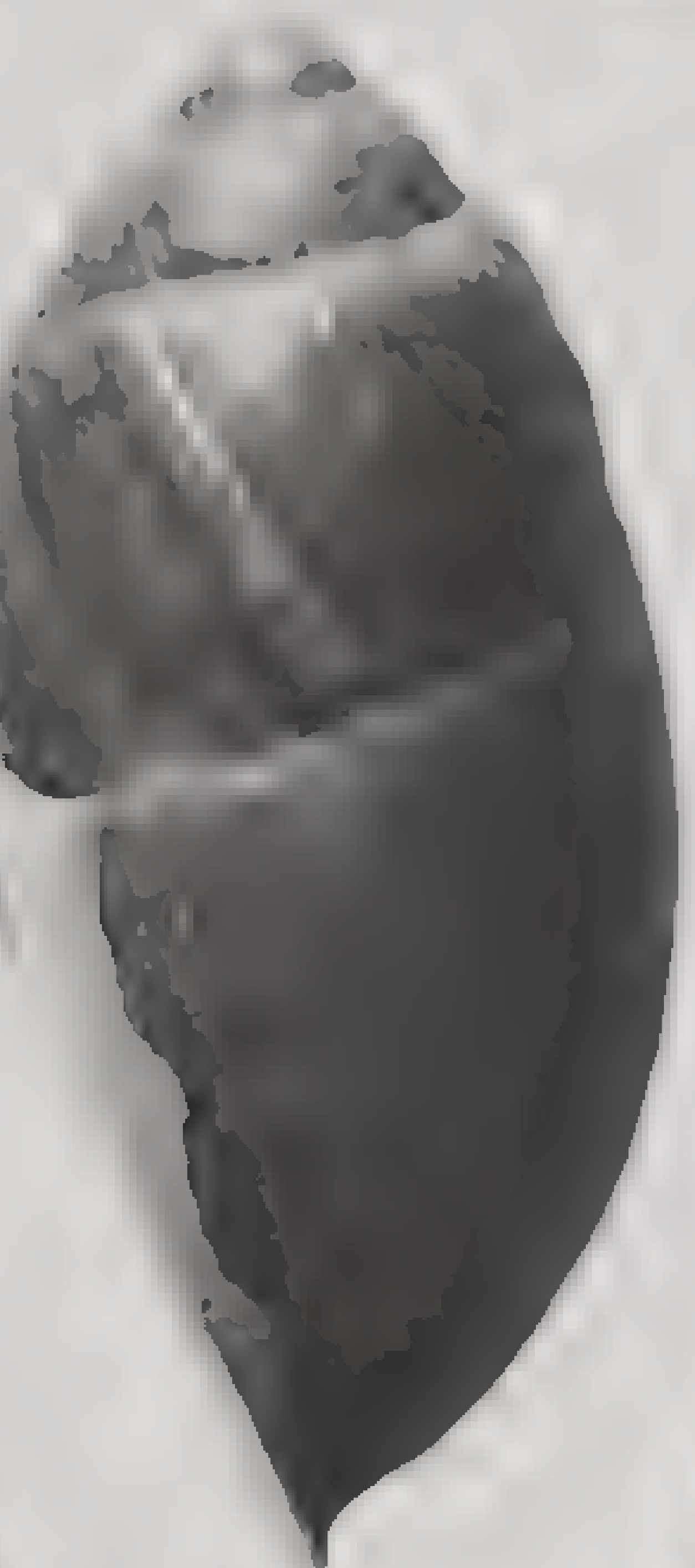
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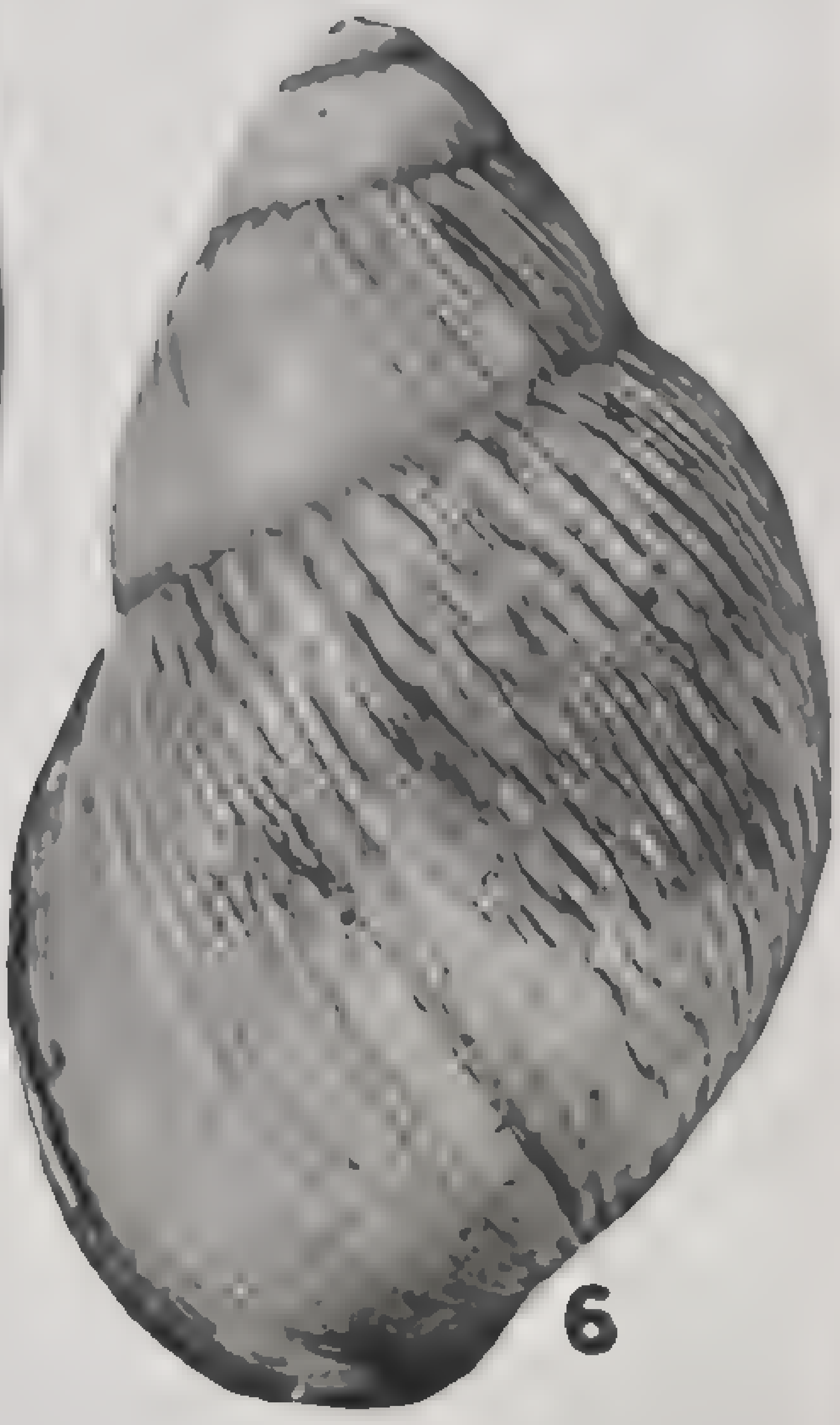
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PLATE 32

PLATE 32

Fig. 1. Egg of *Strophocheilus milleri kronei* H. v. Ihering. Rio Grande. M.C.Z. No. 179242.

Fig. 2. *Strophocheilus bronni* (Pfeiffer). Brazil. M.C.Z.

Fig. 3. *Strophocheilus granulosus* (Rang). Holotype. Cantagallo. Paris Museum. Courtesy of Dr. E. Fischer.

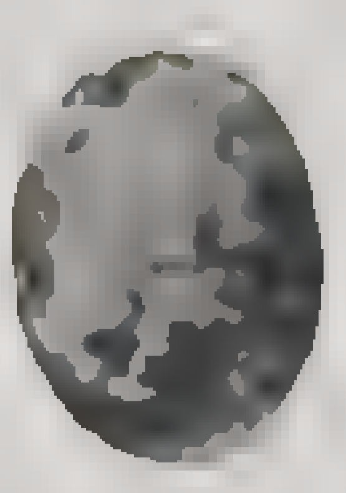
Fig. 4. *Strophocheilus planidens* (Michelin). Cotype. Brazil. Paris Museum. Courtesy of Dr. E. Fischer.

Fig. 5. *Strophocheilus calus* Pilsbry. Brazil. M.C.Z.

Fig. 6. *Strophocheilus d'orbignyi* (Döring). Villarino. M.C.Z. No. 132302.

Fig. 7. *Strophocheilus d'orbignyi* (Döring). Bahia Blanca. M.C.Z. No. 151086.

Fig. 8. Egg of *Strophocheilus oblongus* (O. F. Müller). Barbados. M.C.Z.
All Natural Size.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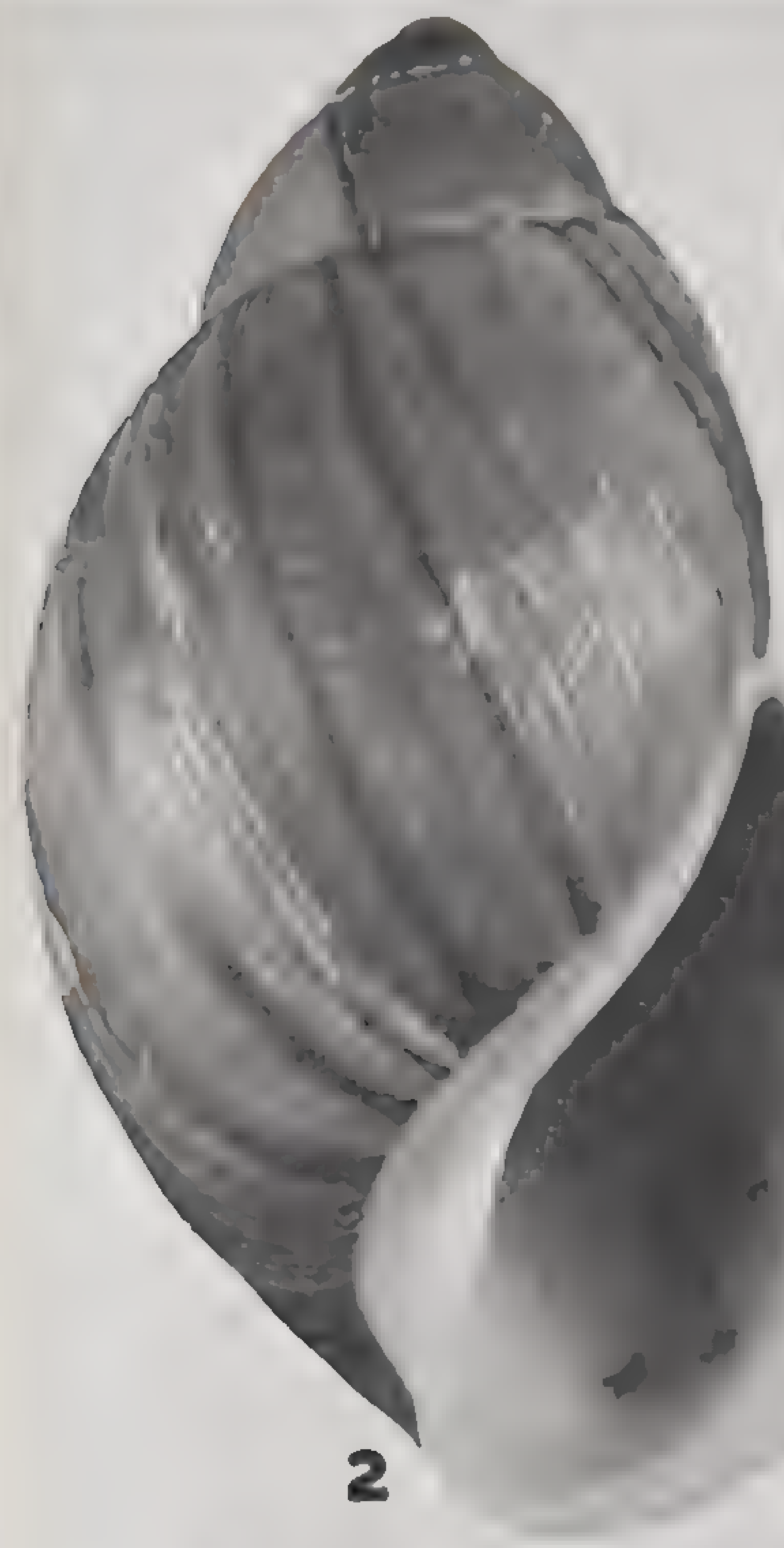
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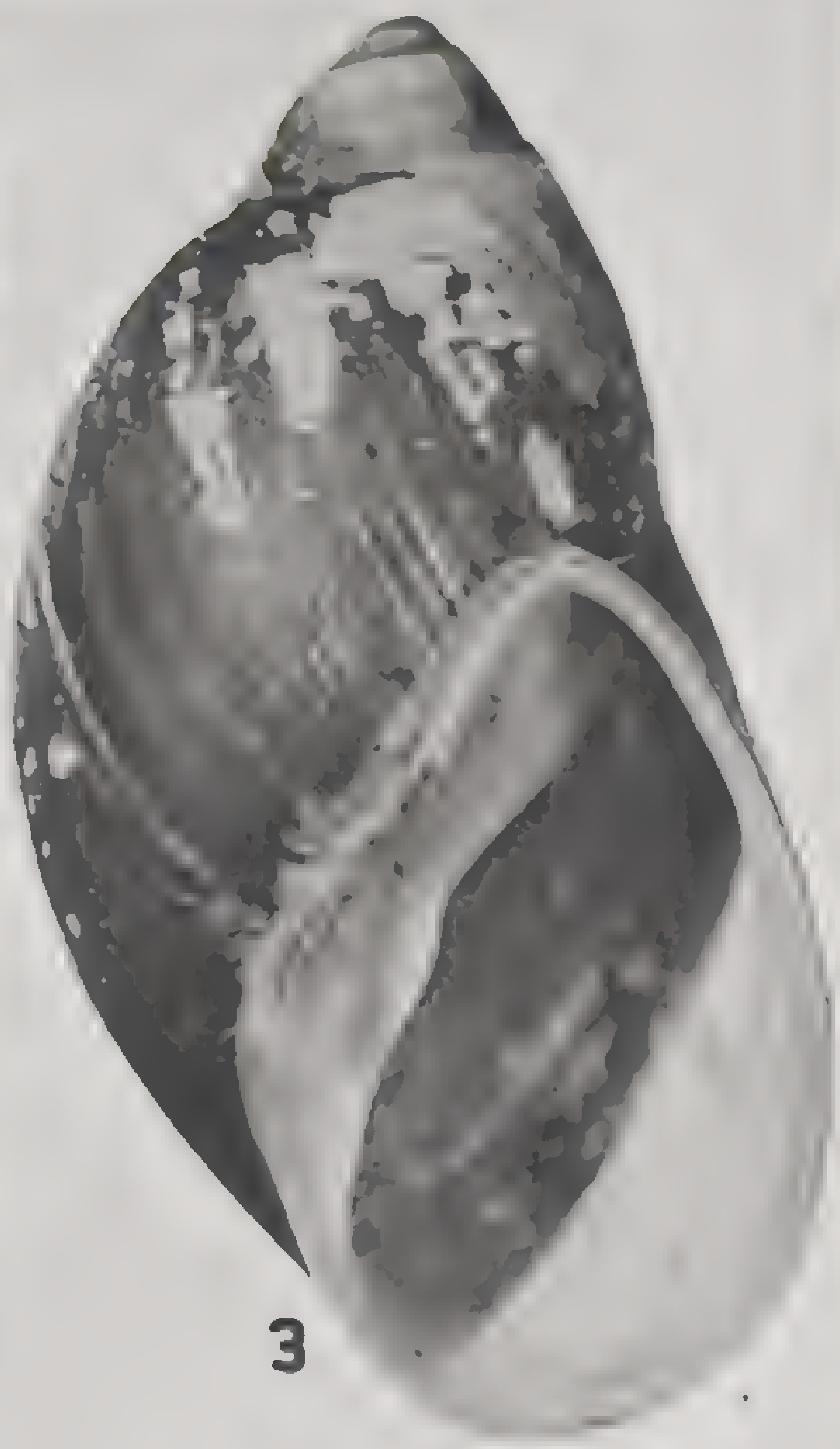
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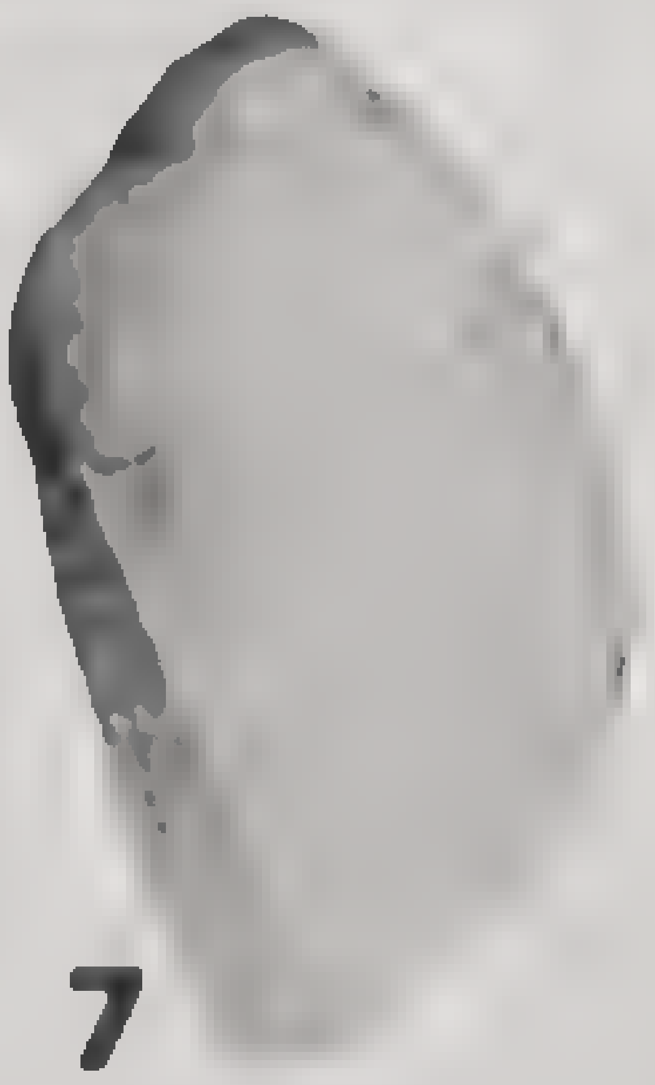
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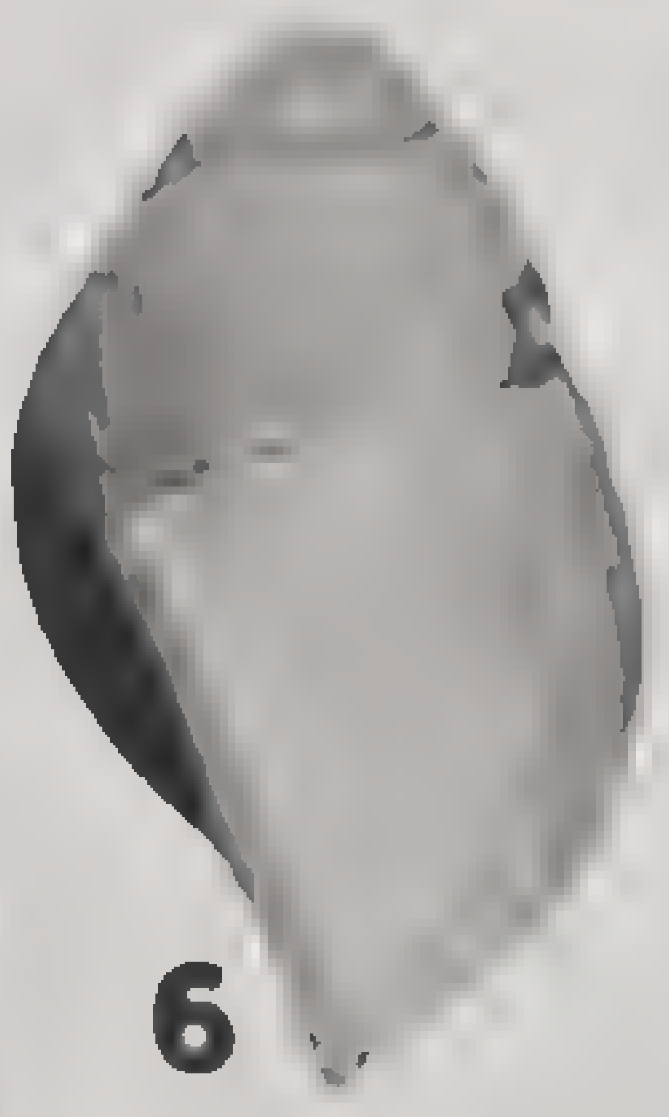
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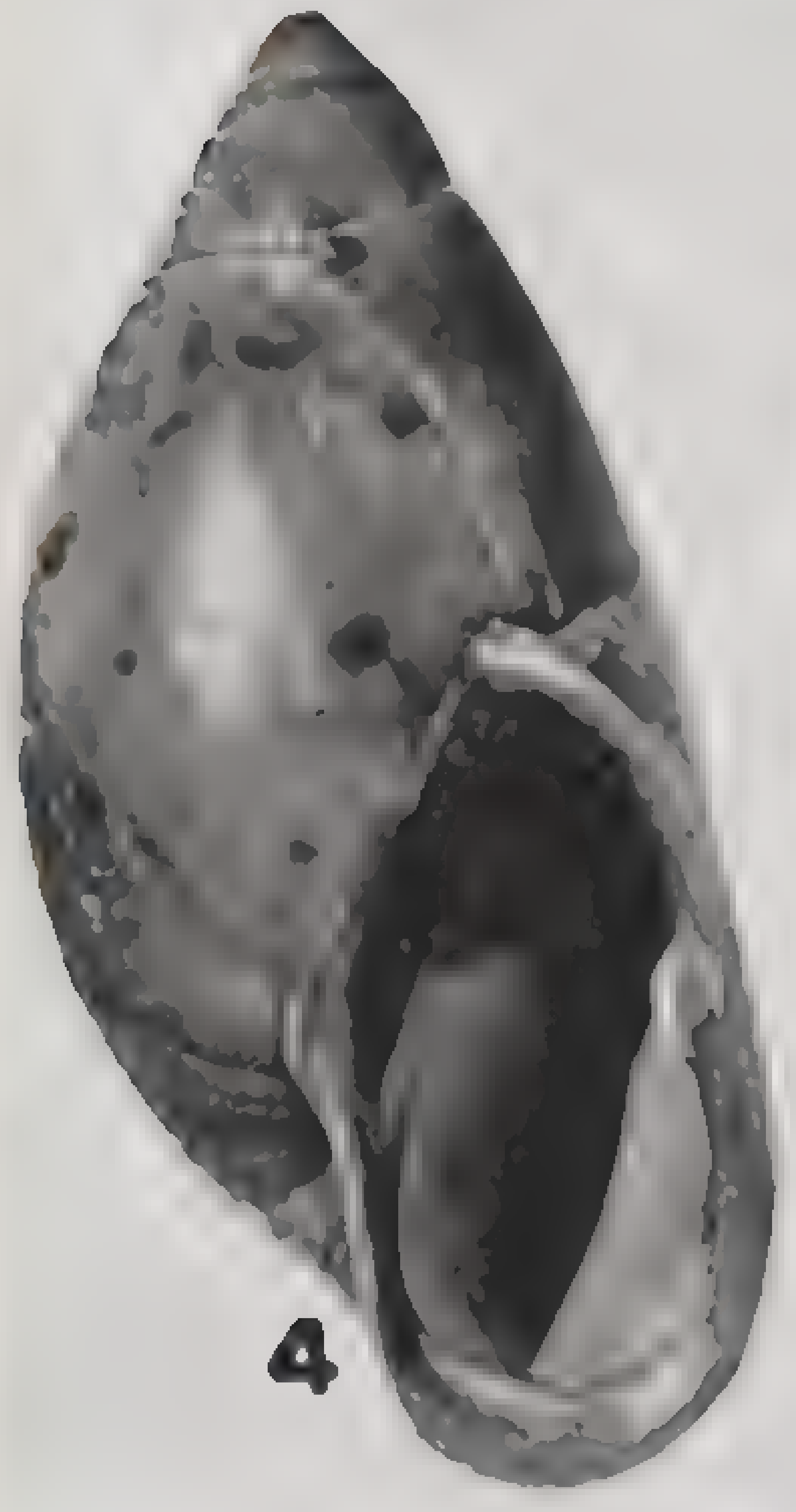
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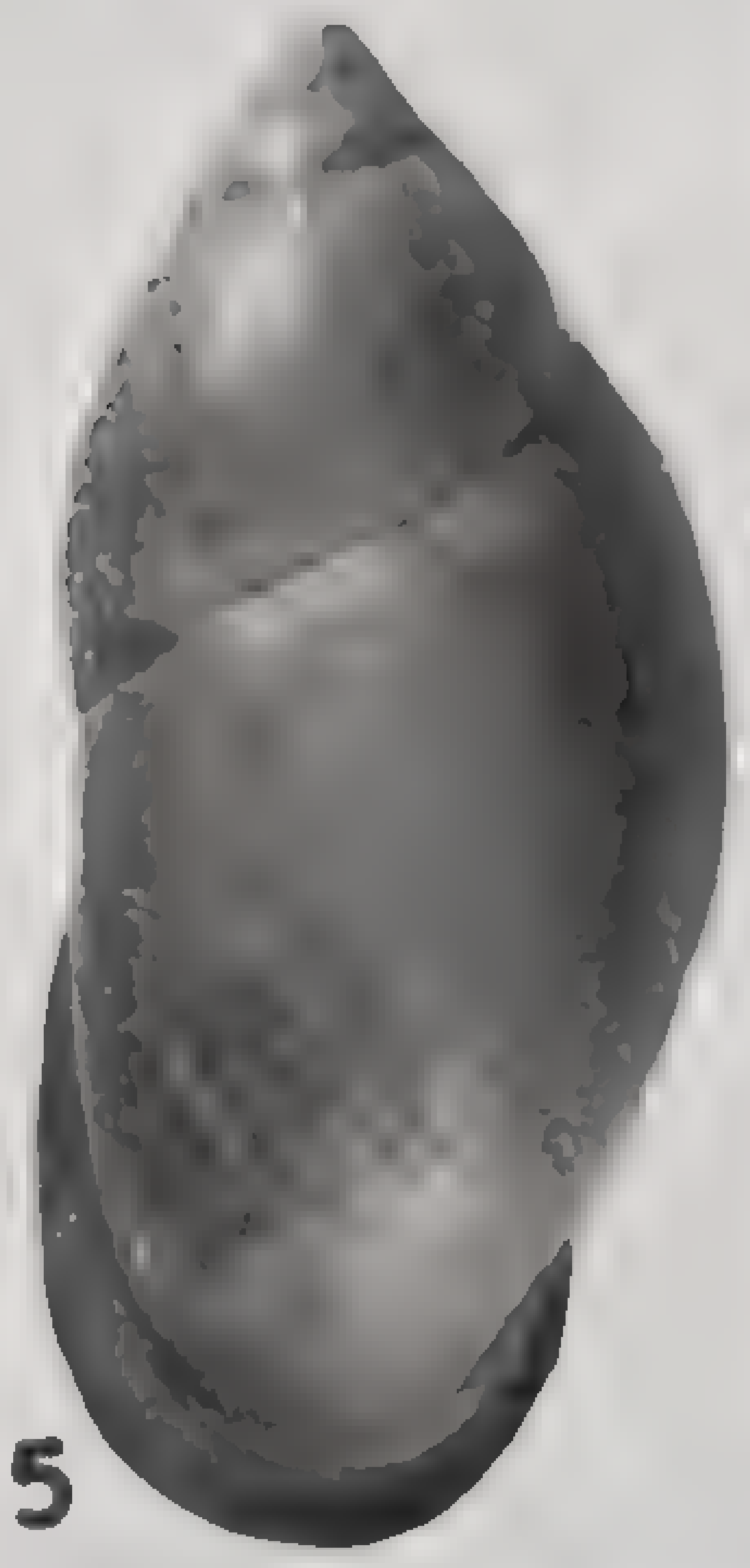
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Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
Vol. 100, No. 2

FORAMINIFERA OF THE CONTINENTAL SHELF FROM THE GULF OF MAINE TO MARYLAND

By Frances L Parker

With Seven Plates

CAMBRIDGE, MASS., U.S.A.
PRINTED FOR THE MUSEUM
April, 1948

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OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
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No 2. — *Foraminifera of the Continental Shelf from the Gulf of Maine to Maryland*[1]

By Frances L. Parker

CONTENTS

Page
Introduction 214
  General statement 214
  Acknowledgments 215
Location of samples 215
Method of study 217
  General statement 217
  Treatment of samples 218
Faunal zones 220
  General statement 220
  Region from Cape Cod to Maryland 221
    Zone 1, 0–15 meters 221
    Zone 2, 15–90 meters 221
    Zone 3, 90–300 meters 223
    Zone 4, 300–680 meters 225
  Region east and north of Cape Cod 226
    Cape Cod Light traverse 226
    Ipswich Bay traverse 228
Relationship of faunas to physical conditions 228
  General statement 228
  Light penetration 229
  Temperature 229
  Salinity 232
  Food supply 233
  Abundance of specimens 233
Planktonic Foraminifera 234
Conclusions 236
Species referred to in text and tables 237
Bibliography 241

LIST OF ILLUSTRATIONS

Figures Page
1. Map showing location of traverses 216
2. Percentage distribution of selected key Foraminifera south of Cape Cod 220

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[1] Contribution No. 376. Woods Hole Oceanographic Institution.

Page
3. Maximum and minimum bottom temperatures in relation to depth on a profile running southeast from Montauk Point, Long Island...... 230
4. Relative abundance of planktonic foraminifera in relation to depth.. 234

Tables (at back)
1. Percentage distribution of the benthonic fauna in the Maryland traverse.
2. Percentage distribution of the benthonic fauna in the New Jersey traverse.
3. Percentage distribution of the benthonic fauna in the Block Island traverse.
4. Percentage distribution of the benthonic fauna in the Marthas Vineyard traverse.
5. Percentage distribution of the benthonic fauna in the Cape Cod Light traverse.
6. Percentage distribution of the benthonic fauna in the Ipswich Bay tratraverse.
7. Percentage distribution of the planktonic fauna in the Maryland traverse.
8. Percentage distribution of the planktonic fauna in the New Jersey traverse.
9. Percentage distribution of the planktonic fauna in the Block Island traverse.
10. Percentage distribution of the planktonic fauna in the Marthas Vineyard traverse.

Plates (at back)
1. Species typical of Zone 2
2. Species typical of Zone 3
3. Species typical of Zone 3
4. Species typical of Zone 4
5. Species not confined to one zone
6. Species not confined to one zone
7. Planktonic species

INTRODUCTION

GENERAL STATEMENT

This is one of two projected papers concerning the Foraminifera of the continental shelf of the western North Atlantic. It concerns that part of the continental shelf extending from the Gulf of Maine to Maryland. The sediments were collected under the direction of Henry C. Stetson of the Woods Hole Oceanographic Institution during several trips of the research ships *Atlantis* and *Asterias*. The samples were those used by Stetson in his study of the sediments of the continental shelf. A description of the dredge used in obtaining the material and a discussion of the sediments may be found in his paper (Stetson, 1938).

The foraminiferal faunas from the bottom sediments have been studied in a quantitative manner and an especial inquiry has been made into the possibility of establishing faunal zones correlated to depth for different foraminiferal assemblages. Although a considerable amount is known about the general habitat of different genera and species of Foraminifera, such information is quite inadequate for attacking certain oceanographic and geologic problems. Detailed data on the depth ranges of these faunas on the continental shelf should be important in interpreting the more recent history of the ocean, as recorded in submarine cores. Moreover, if certain principles of faunal distribution can be established, such information should be of value in interpreting marine rocks of Cretaceous and Tertiary age.

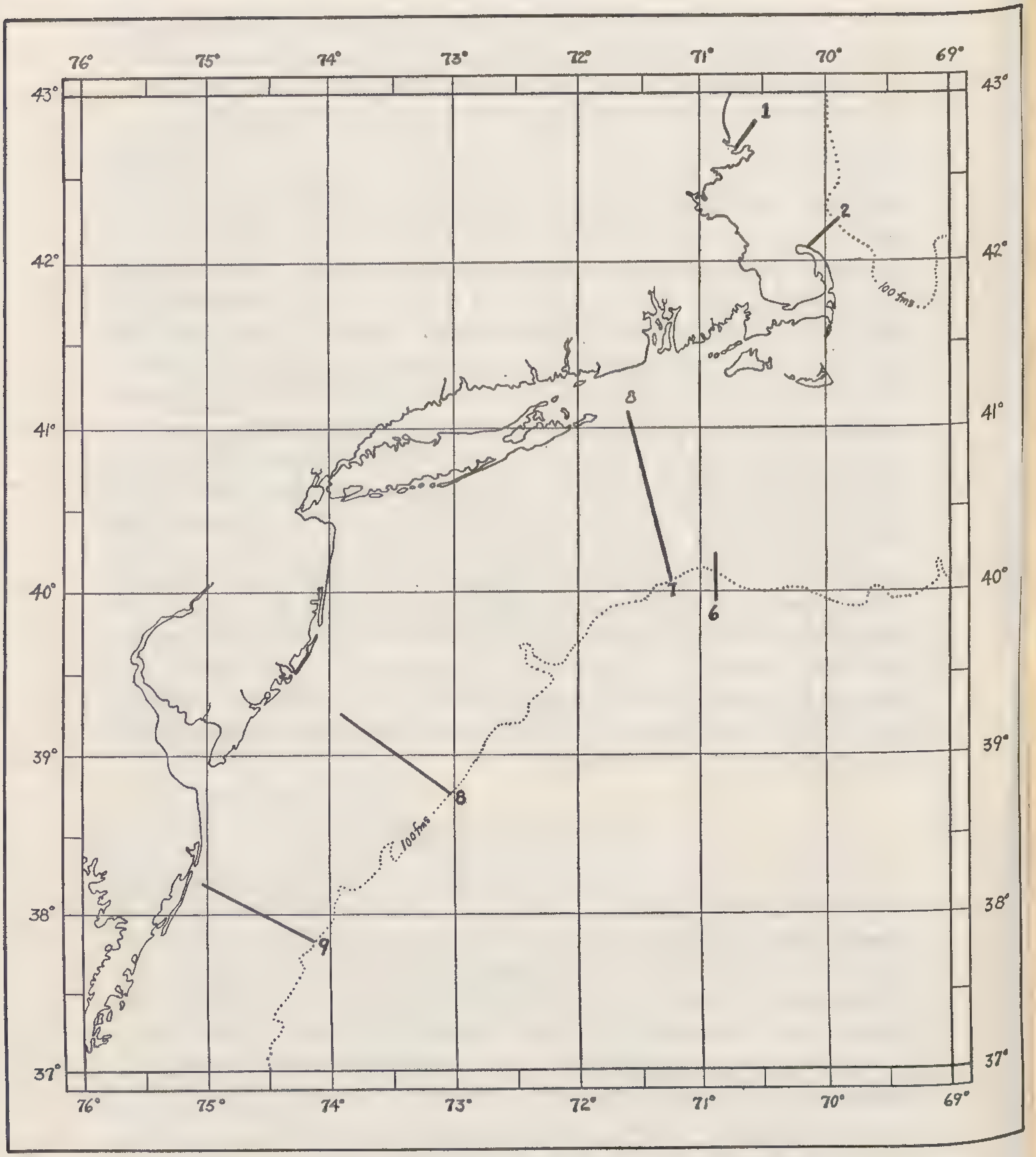
It has been found that there are four definite faunal zones in the region studied. It is impossible, however, at the present time to give definite causes for this zoning, because of lack of knowledge concerning the habits and life histories of the living organisms. Few facts are known concerning the effect of temperature, salinity, and depth. Little is known of the nutritional requirements, migratory habits, and other factors. Certain physical features of the various zones studied have been indicated and some fairly reasonable hypotheses may be deduced from these. At the present state of our knowledge it is impossible, however, to determine with any precision the conditions which will produce a given assemblage.

ACKNOWLEDGMENTS

This work was made possible by the assistance and cooperation of the Woods Hole Oceanographic Institution. Particular thanks are due Messrs. Henry C. Stetson and Fred B. Phleger for their advice and suggestions throughout; to Dr. Joseph A. Cushman for his help in photographing specimens, to Constance French for drafting the figures, and to Miss Ellen Meehan for several drawings. Valuable help and criticism have also been given by Lloyd G. Henbest of the U. S. Geological Survey and Shepard W. Lowman of the Shell Oil Company.

LOCATION OF SAMPLES

The marine bottom samples used for the present study were taken in a series of traverses across the continental shelf out to, or slightly


76°
75°
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70°
69°
43°
42°
41°
40°
39°
38°
37°
1
2
100 fms.
8
7
6
8
100 fms
9

Figure 1. Map showing location of traverses.

beyond, the break in slope. The samples were taken at regular intervals, in most cases one mile apart (Stetson, 1938, pp. 41–44). There are four traverses south of Cape Cod located as follows: 71 miles south of Marthas Vineyard on a line beginning at 40° 11′ N, 70° 48′ W and running from 122 meters to 680 meters (series 6); 1¼ miles southwest of Block Island on a line running 167° from the whistling buoy and running from 19 meters to 200 meters (series 7); off the coast of New Jersey beginning at 39° 14′ N, 73° 54′ W and running offshore in a southeasterly direction from 46 meters to 610 meters (series 8); off the coast of Maryland, beginning at 38° 12′ N, 75° 02′ W and running offshore in a southeasterly direction from 22 meters to 386 meters (series 9). These lines cross the shelf from the very shallow water to the break in slope with the exception of the Marthas Vineyard traverse which starts at its northern end at a depth of 122 meters. There are two short traverses in the region east and north of Cape Cod: on a line running 46° from the beach at Cape Cod Light from 12 meters to 203 meters (series 2); on a line running 35° from can buoy No. 1 at entrance to Essex River, Ipswich Bay, Mass., from 9 meters to 71 meters (series 1). A total of 86 samples were studied, 70 of which have been included in the faunal tables.

METHOD OF STUDY

GENERAL STATEMENT

An attempt has been made to give the facts concerning the occurrence of Foraminifera in a manner which will easily lend itself to analysis and interpretation. A study of the various faunas involved showed that some way of simplification would have to be devised to make it possible to deal with the great abundance of material. In order to do this the different species have been counted and their relative abundances determined on a percentage basis. The actual abundance of Foraminifera has also been estimated for samples of standard size. Many rare forms have been necessarily omitted and in samples containing a very high percentage of Foraminifera many occurrences, which from their abundance seem to be important, have been found to be of small significance. Species occurring with a percentage of less than 0.1% have been omitted from the tables and very occasionally species occurring in higher percentages, if they appear to be of no significance. A few rare forms which do not appear in the tables have been listed separately when they have occurred persistently in several samples and when they seem to have a definite value in zonal analysis. By this procedure it has been possible to cut down the working fauna from about 300 species to about 150. The danger of drawing conclusions from spotty occurrences of species in small numbers also has been eliminated.

The value of the percentage method in presenting the facts lies in the ease with which a definite analysis can be made of the relative importance of the various species in the different samples. This cannot be done if species are merely listed as common, rare, etc. In many cases it was found that samples having comparatively few specimens showed similar percentages of the various species as did a rich sample. For the sake of brevity and to avoid needless repetition the data of only part of the samples studied is given in the accompanying tables. Zonal changes were so gradual and often so many samples showed exactly similar conditions that it seemed unnecessary to give the listings of all of them. These samples served as a useful check, however, and helped to bring to light abnormalities due to localized conditions.

TREATMENT OF SAMPLES

In order to give a rough estimate of the actual abundance of the Foraminifera in a sample, a standard amount of 100 cc. of sediment was used. In cases where this amount was not available, or the silt and clay had been previously sieved out for mechanical analysis, computations were made to standardize the results. The material was treated with carbon tetrachloride according to the method developed by Dr. Ozawa at the Cushman Laboratory (Cushman, 1940, p. 27). In some cases it was found that an appreciable percentage of the forms had not floated due to their large size or due to the thickness of the test walls. In such cases the residues were examined separately and the figures included with those of the floated sample. In most cases these figures did not materially change the percentage figures already determined, but the ratios were considerably changed in samples where such forms as *Marginulina bacheii* Bailey[1] and *Gaudryina* (*Pseudogaudryina*) *atlantica* (Bailey) were found.

In counting the specimens, flotations smaller than 0.1 cc. in volume could be used in their entirety and total counts made. For larger samples a simple apparatus to divide the material was devised. This consisted of a tray four inches square divided in the middle by a brass partition whose upper edge had been ground to a knife edge. A trough with a v-shaped cross section was soldered to this partition at an angle of forty-five degrees. The lower end of the trough was split so that the sides could extend down on either side of the brass partition. The material was allowed to slide down the trough and was divided into approximately two parts by the knife edge. In this way it was possible to divide the samples many times without getting unequal divisions of the different grade sizes, even when the divisions were extremely small. The accuracy of the divisions was checked by counts and the percentage differences were found to be very small. In all cases where it was found necessary to divide the sample, two aliquots were taken, one from divisions made using one side of the apparatus and one from those using the other. Parallel counts were made and the results of the two averaged. In this way errors that might result from faulty division due to the lack of precision of the apparatus were reduced. Each sample was weighed before division and the resulting aliquots weighed after counting, so that an estimate of the actual abundance of the species could be made.

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[1] A list of species giving plate and figure numbers will be found on page 237.

Over 300 species were identified from all the samples studied, but of these only about 150 were found to be useful in the problem at hand. Counting and calculating each rare species separately was found to be a waste of effort in most cases. Such species were included under "miscellaneous forms." A preliminary examination of the entire sample is a useful guide to the relative importance of the various species. In the present instance the different species were picked out from small samples and a preliminary list of the significant forms compiled. The time involved in doing this is great, however, and once the worker is familiar with the fauna it is not necessary.

It should be realized that the figures obtained by this procedure, no matter how much care is taken, are subject to error. The methods are necessarily rough from the initial sampling to the exact counting of the specimens and it would seem absurd to give actual figures, especially in the case of the estimates of the total numbers of Foraminifera to be found in a sample. For this reason the actual abundance is given in an estimated round number which should be regarded only as an approximation. The actual percentage figures computed are given, but here also some latitude should be allowed. This is especially true of samples where the planktonic forms make up a large proportion of the material. In order to get a fair representation of benthonic forms it was necessary to count a fairly large aliquot.

In working out the percentages the planktonic forms were separated from the benthonic. This has not been done by most authors, but it seems necessary in view of the fact that at least two different environments are represented and a mixture of these elements would give an untrue picture of the facts, biologically, and lead to a false interpretation. For want of more complete data, the conventional list of planktonic forms has been used. It is probable, however, that certain planktonic forms may have bottom-living stages and even more probable that bottom-living ones have planktonic, or semi-planktonic, stages. The possibility that zoospores may be carried considerable distances should be kept in mind. These are added complications which must be minimized at the present stage of our knowledge.

FAUNAL ZONES

GENERAL STATEMENT

In discussing the zoning of the Foraminifera on the continental shelf, it is necessary to divide the area into two parts. The first part includes the region from Maryland to Cape Cod, the second that east and north of Cape Cod. It is interesting to note that Cape Hatteras forms the boundary of yet a third faunal region. Within these regions more or less similar conditions prevail, but there is a marked difference between the faunal characteristics of the regions. Since the sampling south of Cape Cod has been more widespread and complete, the findings in that region will be used as a gauge for those in the northern. Definite bathymetric limits are given for the zones, but these should be considered as only approximate. In the discussion of the zones only the benthonic fauna is considered.

The identifications of the species have been taken chiefly from Cushman's monograph of the Foraminifera of the Atlantic Ocean (Cushman, 1918–1931). Some of these identifications are probably not up to date, but since it is not the purpose of this paper to give a strictly faunal study it has seemed more practical to use the names which have become familiar with usage. Many of the genera, which have been re-named in more recent studies, have been changed to conform with the later classifications; in some places where it has seemed expedient species names also have been corrected. All the species listed have definite percentage ratings of one-tenth of one percent, or more, in the samples unless specifically designated as *rare*. They do not necessarily appear in every sample of a zone, but are nevertheless considered to be diagnostic.

Figure 2. Percentage distribution of selected key Foraminifera south of Cape Cod

REGION FROM CAPE COD TO MARYLAND

ZONE 1. 0—15 METERS

This includes the littoral and sub-littoral zones. The traverses do not penetrate this zone, but material has been collected in Buzzards Bay in different types of sediment. Since Dr. Cushman is planning a detailed study of this fauna, only a few general points will be indicated. The samples taken in sand yield the richest fauna. Various species of *Elphidium* form the bulk of the samples, with *Rotalia beccarii* (Linnaeus), *Quinqueloculina seminulum* (Linnaeus), and *Eggerella advena* (Cushman) present in appreciable quantities. Samples taken in mud show a very few *Quinqueloculinas* and *Guttulinas* with a slightly higher percentage of *Eggerella advena*. Definite counts have not been made of this material and for the reasons given above no detailed study has been made. In general it may be said that bottom samples of the littoral zone would probably show a very high percentage of *Elphidium* throughout this area.

ZONE 2. 15—90 METERS

The 15 meter limit given to the inner edge of this zone is subject to some qualification. None of the samples taken in the traverses were from depths shallower than 19 meters. The depth of 15 meters has been chosen for the inner limit of Zone 2 in open ocean conditions, since this depth is well below the tide level and at a sufficient distance from the shore. Samples taken in an enclosed bay at this depth, however, may differ materially, as was shown when material taken at 19 meters south of Block Island was compared with that taken in 17 meters in Buzzards Bay.

The following species were found in the Maryland, New Jersey, and Block Island traverses in Zone 2 only:

Quinqueloculina seminulum (Linnaeus)
Triloculina sp. (extends somewhat into Zone 3 in the Maryland traverse)
Eggerella advena (Cushman) (occurs in the first sample in Zone 3 of the Maryland traverse)
Globulina inaequalis Reuss var. *caribea* d'Orbigny (first sample of Zone 3 in Maryland traverse)
Trochammina lobata Cushman
Bolivina pseudoplicata Heron-Allen and Earland (found in 3 samples in Zone 3 of the Maryland traverse, at very low percentages)

The following species were found in abundance in the Maryland and New Jersey traverses, but occurred only rarely in the one off Block Island:

Globulina inaequalis Reuss
Cibicides concentrica Cushman

The following species were found with percentage rating in the Maryland traverse, but occurred only rarely in the New Jersey and Block Island traverses:

Nonion sloanii (d'Orbigny)
Elphidium sp.
Quinqueloculina seminulum (Linnaeus) var. *jugosa* Cushman
Pyrgo striatella (Cushman)

Discorbis sp. 2 and *Buliminella elegantissima* d'Orbigny were found only in the Maryland traverse. *Angulogerina* sp. 1 was found off New Jersey and rarely off Maryland.

Haplophragmoides major Cushman occurred only in the Block Island traverse with a single specimen found in each of the others.

It is interesting to note the occurrence of *Poroeponides lateralis* (Terquem) in the shallowest sample taken off Block Island, in 19 meters. This species has hitherto only been recorded from the littoral zone in this part of the Atlantic, which suggests that this sample was taken near the transitional point between the first two zones. The species occurred rarely at 37 meters.

Ammodiscus sp. was found only in this zone, occurring rarely in all three traverses.

Of the species given above *Quinqueloculina seminulum, Eggerella advena,* and *Triloculina* sp. have the highest percentages. As a study of the tables will show, however, they never form, taken together, more than 30% of a sample and usually considerably less. The species, in addition to these, which form the bulk of the samples, with of course some variation between traverses, are: *Proteonina difflugiformis* (H. B. Brady), *Elphidium subarcticum* Cushman, *Elphidium incertum* (Williamson), *Cibicides refulgens* Montfort, *Elphidium* sp. found in quantity only in the Maryland traverse, *Guttulina lactea* (Walker and Jacob), *Eponides frigida* (Cushman) var. *calida* Cushman and Cole. *Bulimina marginata* d'Orbigny appears at high percentages at the deeper end of the zone. The species given above do not necessarily reach their highest percentages in this zone, but do form a large proportion of the samples when taken together. As it was very difficult to differentiate the broken off chambers of *Reophax scorpiurus* Montfort from the specimens of *Proteonina difflugiformis* and as neither form appeared to have any great significance in this study, no attempt was made to separate them and they are listed together under the latter name. It is interesting to note that *Cibicides refulgens* reaches its highest percentages at 60–70 meters in the Maryland and New Jersey traverses, but does not even appear in the Block Island samples in material shallower than 117.7 meters, except rarely.

ZONE 3. 90—300 METERS

All four traverses in the Cape Cod to Maryland region penetrate this zone. It was possible to fix the outer limit fairly closely in the short traverse taken south of Marthas Vineyard. The change occurs between the 228 meter sample and the 300 meter sample. In the New Jersey and Maryland lines, consecutive samples go from 154 to 386 meters and 182 to 610 meters respectively, so that in these traverses it was impossible to define the limits of the zones very closely. The Block Island traverse ends at 200 meters and, therefore, does not penetrate the fourth zone. The third zone has the richest benthonic fauna both in actual abundance and in number of species found. An example of this may be seen in the Lagenidae, which are confined almost entirely to this zone and of which there are present at least 100 species, some of them occurring rarely but others in great numbers. The group as a whole sometimes forms as much as 25% of a sample, although, as a rule, it forms about 5%. In zone 4 this percentage drops to 1% or less. The larger proportion of the species occur rarely and cannot be considered separately, but taken together they become of considerable importance. In the tables these rare species have been counted together and grouped under "miscellaneous Lagenidae."

The following species are confined to Zone 3:

Gaudryina (*Pseudogaudryina*) *atlantica* (Bailey)
Pseudoclavulina novangliae (Cushman)
Massilina sp.
Pyrgo cf. denticulata (H. B. Brady) (rare in Marthas Vineyard and New Jersey traverses)
Robulus sp. 1 (rare in the Maryland traverse) [1]
Robulus sp. 2
Robulus sp. 3. (rare in New Jersey traverse)
Marginulina bacheii Bailey
Miscellaneous Lagenidae (extend somewhat into Zone 4)

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[1] Owing to the great confusion existing in the nomenclature of this genus, no attempt has been made to give the species definite names.

Nonion grateloupi (d'Orbigny) (rare in the Marthas Vineyard traverse)
Nonion cf. *barleeanum* (Williamson) (rare in the New Jersey traverse)
Nonionella turgida (Williamson)
Virgulina compressa (Bailey)
Gyroidina soldanii d'Orbigny (rare in the Maryland traverse)
Discorbis bertheloti (d'Orbigny) (rare in the New Jersey and Maryland traverses)
Eponides sp. (rare in the Block Island and New Jersey traverses)
Eponides umbonata (Reuss) var. *ehrenbergi* (Bailey) (rare in the Maryland traverse)
Epistomina elegans (d'Orbigny)
Cassidulinoides bradyi (Norman) (occurs in one sample in Zone 4 in the Marthas Vineyard traverse)
Planulina foveolata (H. B. Brady)
Textularia goessi (Cushman) (?) (occurs only in the Block Island and Marthas Vineyard traverses. It is found rarely in one sample of the Maryland traverse)
Cancris sagra (d'Orbigny) (rare in Marthas Vineyard and Block Island traverses)
Pulvinulinella cf. *exigua* (H. B. Brady) (rare in Marthas Vineyard and Block Island traverses)

The following species are confined to this zone and occur in some abundance although they form a negligible percentage of the samples and are, therefore, considered to be "rare."

Textularia pseudotrochus Cushman
Textularia candeina d'Orbigny
Karreriella affinis (Fornasini)
Pyrgo subsphaerica (d'Orbigny)
Trochammina globigeriniformis (Parker and Jones)
Pseudopolymorphina atlantica (Cushman and Ozawa)
Chilostomella ovoidea Reuss (does not occur in the New Jersey traverse)

Plectina apicularis (Cushman) and *Robertina* sp. are found only in the Block Island and Marthas Vineyard traverses. They occur rarely with the exception of one occurrence of the former off Block Island.

The following species occur in other zones but reach their percentage peaks in Zone 3:

Cassidulina laevigata d'Orbigny
Cassidulina crassa d'Orbigny (rare in the Block Island and Marthas Vineyard traverses)

Cassidulina sp. (rare in the Marthas Vineyard traverse)
Angulogerina angulosa Williamson (reaches its peak in Zone 4 of Maryland traverse)

Zone 4. 300—680 Meters

The data available at the present time are insufficient to fix the outer limit of this zone. Phleger (1942, p. 1081) places it between 600 and 1000 meters. The most noticeable change there is the greatly increased abundance of *Uvigerina peregrina* Cushman, which in many samples forms a very high percentage of the benthonic fauna. None of the samples of the traverses, the deepest of which was taken at 680 meters, penetrated a fifth zone.

Zone 4 is best represented in the Marthas Vineyard traverse. The Maryland and New Jersey traverses each penetrated it at one station. The zone is not represented in the Block Island series.

The fauna of this zone is not so rich in variety of species having a definite percentage value as is that of Zone 3. For this reason the list of forms confined to it is much shorter than that of Zone 3. The species found in this zone only are:

Listerella nodulosa (Cushman) (occurs in the last station of Zone 3 in the Marthas Vineyard traverse)
Ammosphaeroidina sphaeroidiniformis (H. B. Brady) (rare in New Jersey and Maryland traverses)
Bulimina exilis (H. B. Brady) (rare in Maryland traverse)
Bulimina marginata d'Orbigny var.
Gyroidina orbicularis d'Orbigny
Valvulineria sp. (rare in the Maryland traverse)

The following forms were found only at the two deepest stations, 610 and 680 meters, occurring only rarely at the former:

Nonion grateloupi (d'Orbigny) var.
Angulogerina angulosa (Williamson) var.
Uvigerina peregrina Cushman

Cassidulina norcrossi Cushman occurs in Zones 3 and 4 but reaches a much higher percentage in Zone 4.

The following species occur in Zones 3 and 4 but not in Zone 2:

Bolivina subaenariensis Cushman
Eponides umbonata (Reuss)
Bulimina (Desinobulimina) turgida Bailey
Uvigerina sp.
Uvigerina peregrina Cushman var. *bradyana* Cushman
Cassidulina sp. (does not occur in the Marthas Vineyard traverse)

The following species occur rarely and are confined almost entirely to Zone 4:

Valvulina conica Parker and Jones (0.7% at 610 meters in New Jersey traverse)
Karreriella bradyi (Cushman)
Pseudoglandulina occidentalis (Cushman)
Bolivina subspinescens Cushman (found at 610 meters and 680 meters; only single specimens found elsewhere)

REGION EAST AND NORTH OF CAPE COD

In the region east and north of Cape Cod a very different assemblage is found from that occurring between Cape Cod and Maryland. The fauna is much less rich in species and many species which occur only rarely in the southern region form high percentages of the samples. A few species are found which occur only in this region. The chief difference, however, in the faunas of the two regions lies in the absence in the northern of a large number of the forms found in the southern.

It is impossible to divide this region into definite zones. Various zonal distinctions can be made in the two traverses, but there is no apparent correlation between them. This may be due in part to insufficient sampling and the comparative shortness of the traverses (Cape Cod Light traverse—13 miles; Ipswich Bay traverse—6 8/10 miles). It is more probably due to the physical characteristics of the region. In the discussion of the temperature conditions found in the various zones, given later in this paper, it will be shown that definite correlations can be made between temperature conditions and zonal changes. In the northern region these temperature differences are not so sharply defined as they are in the southern. This is due to the complete breakdown of the stability of the water during the winter months throughout the region in which the traverses were made.

Cape Cod Light Traverse

A close analysis of Table 5 shows that there is some suggestion, at least, of zoning in this traverse. It is impossible, however, to give any exact limits to the zones.

The first station at the inner end of the traverse, located ½ mile from shore at a depth of 5 meters, has been omitted from Table 5. This is due to the unusual assemblage found. Various species occurred which were not found elsewhere in the traverse or in the whole northern area. These species, many of them planktonic forms in poor condition, were typical of the area south of Cape Cod and it is probable that they were carried to their present location by the strong tidal current which runs along the shore. Further evidence of the presence of strong currents is found in the 12, 32, and 48 meter samples, all of which contain a very small number of Foraminifera. Stetson points out (1938, p. 18) that in the area covered by this traverse there is strong evidence that the bottom has been scoured out to a depth of 70 meters. This fact may account for the scarcity of forms found, and the supposition is that the shallow, 5 meter sample was taken in a location where for some reason the load of material being carried north was deposited.

The first sample to be considered is that taken one mile from shore at a depth of 12 meters. This sample probably lies in the sub-littoral zone. Only 18 specimens were found, representing 8 species. Of these 5 do not appear elsewhere in the traverse (with the exception of one specimen), 4 are attached forms, two species of the genus *Discorbis* and two of the genus *Trochammina*, and are of the type usually associated with a littoral assemblage.

In the section of the traverse from 32 meters to 121 meters, several species having definite percentage ratings are found which are typical of Zone 2 in the area south of Cape Cod. They are:

Haplophragmoides major Cushman (32-144 meters)
Eggerella advena (Cushman) (12-121 meters)
Quinqueloculina seminulum (Linnaeus) (12-48 meters)
Trochammina lobata (Cushman) (70-85 meters)
Ammodiscus sp. (occurs rarely 85-145 meters)

In the section of the traverse from 145-203 meters various species are found which occur only in Zones 3 and 4 farther south. They are:

Valvulina conica Parker and Jones (91-203 meters) (Zone 4)
Triloculina tricarinata d'Orbigny (rare 145-203 meters) (Rare—Zone 4)
Pseudoglandulina occidentalis (Cushman) (Rare—203 meters) (Zone 4)
Bulimina exilis H. B. Brady (rare—203 meters) (Zone 4)
Bolivina subaenariensis Cushman (145-203 meters) (Zones 3 and 4)
Cassidulina norcrossi Cushman (203 meters) (Mostly Zones 3 and 4)
Eponides umbonata (Reuss) (rare 144-203 meters) (Zones 3 and 4)

Astrononion stellatum Cushman and Edwards occurs practically throughout this traverse but it is almost entirely confined to Zones 3 and 4 in the southern area, where it is of rare occurrence.

A number of species which seem to have no zonal significance in the southern region are also found occurring practically throughout this traverse:

Proteonina difflugiformis (H. B. Brady)
Elphidium subarcticum Cushman
Eponides frigida (Cushman) var. *calida* Cushman and Cole
Cassidulina laevigata (d'Orbigny)
Cibicides refulgens (Montfort)

IPSWICH BAY TRAVERSE

This traverse is very short and has a comparatively limited fauna. It does not penetrate into a possible third zone. The first sample taken in 9 meters, close to the mouth of the Ipswich River, has a limited fauna which has no definite littoral characteristics. Several species typical of Zone 2 of the southern region are found throughout the traverse. They are:

Eggerella advena (Cushman)
Haplophragmoides major Cushman (37-71 meters)
Trochammina lobata Cushman (absent at 71 meters)

The bulk of most of the samples is made up of *Proteonina difflugiformis* and *Eggerella advena.* They form between 65% and 85% of the samples.

RELATIONSHIP OF FAUNAS TO PHYSICAL CONDITIONS

GENERAL STATEMENT

The zoning of the region between Cape Cod and Maryland appears to be a direct function of depth. The relationship between zoning and depth is not so clear in the northern area, east and north of Cape Cod, although here too there is some indication of faunal change with depth. There are many physical factors of the ocean water and the ocean bottom which are dependent, to a greater or less extent, upon depth, and the problem is to ascertain which of these are most influential in bringing about the faunal changes of the Foraminifera—in this case especially those of the bottom-living forms. It is necessary to consider such things as light, salinity, temperature, food supply, and sedimentation. It is possible that aeration and pressure also play an important part at times, but in the comparatively shallow depths and open sea conditions with which this paper is immediately concerned these factors are probably of minor importance.

LIGHT PENETRATION

The influence of light can have no direct bearing on the bottom-living Foraminifera except in the littoral zone and Zone 2. Indirectly, of course, it may be important in influencing the food supply of the forms living in the deeper zones. The majority of the species of the Foraminifera live well below the level of maximum light penetration (in measurable quantities). In the shallow depths a few cases have been noted of certain species living commensally with algae (Cushman, 1940, p. 11). George L. Clarke (1936) has made some measurements of light penetration in the western Atlantic and the following table shows some of his findings.

	Red	Green	Violet	Depth of Photosynthesis
Vineyard Sound	13 M	21 M	21 M	
Woods Hole Harbor	13 M	16 M	14 M	18 M
South of Cape Cod (moderate sea)		50 M		
Gulf of Maine	20–25 M	20–75 M	55–60 M	40 M

This table gives the depths of penetration of light of various wavelengths within the visible spectrum and the depth of photosynthesis at two stations. The conditions in the Gulf of Maine approximate those of the coastal water well out on the continental shelf, while the Vineyard Sound and Woods Hole findings are typical of inshore water (Clarke, 1936, pp. 4, 5). Woods Hole Harbor and the Gulf of Maine represent the two extremes and here we find photosynthesis possible down to depths of 18 meters and 40 meters respectively. The compensation point is somewhat less than this: 7 meters in Woods Hole Harbor and 24-30 meters in the Gulf of Maine (Clarke, 1939, p. 36).

TEMPERATURE

Temperature conditions can apparently be closely correlated with zoning. The northern and southern regions will be considered separately. Figure 3 gives the minimum and maximum bottom temperature curves for a profile extending southeast from Montauk Point, Long Island. The temperatures given in the figure have been taken from a series of temperature sections, plotted for various months in the year, made by Columbus O'D. Iselin of the Woods Hole Oceanographic Institution. He says that they may be taken as characteristic of the continental shelf throughout this area (Personal communication).

Using these figures, together with additional data given by Bigelow (1933) for the temperature conditions found in the southern part of the Cape Cod-Maryland region, we find that the approximate temperatures to which each zone is subjected are as follows:

Zone 1 0M–15M	0°–22°C (Vineyard Sound) 0°–27°C (Chesapeake Bay)
Zone 2 15M–90M	3°–16°C (at 50 M the minimum is 6°C)
Zone 3 90M–300M	9°–13°C (at 300M the maximum is 10°C) (at 300M the minimum is 7°C)
Zone 4 300M–1000M	6°–8°C (350M) 5°–6°C (600M)

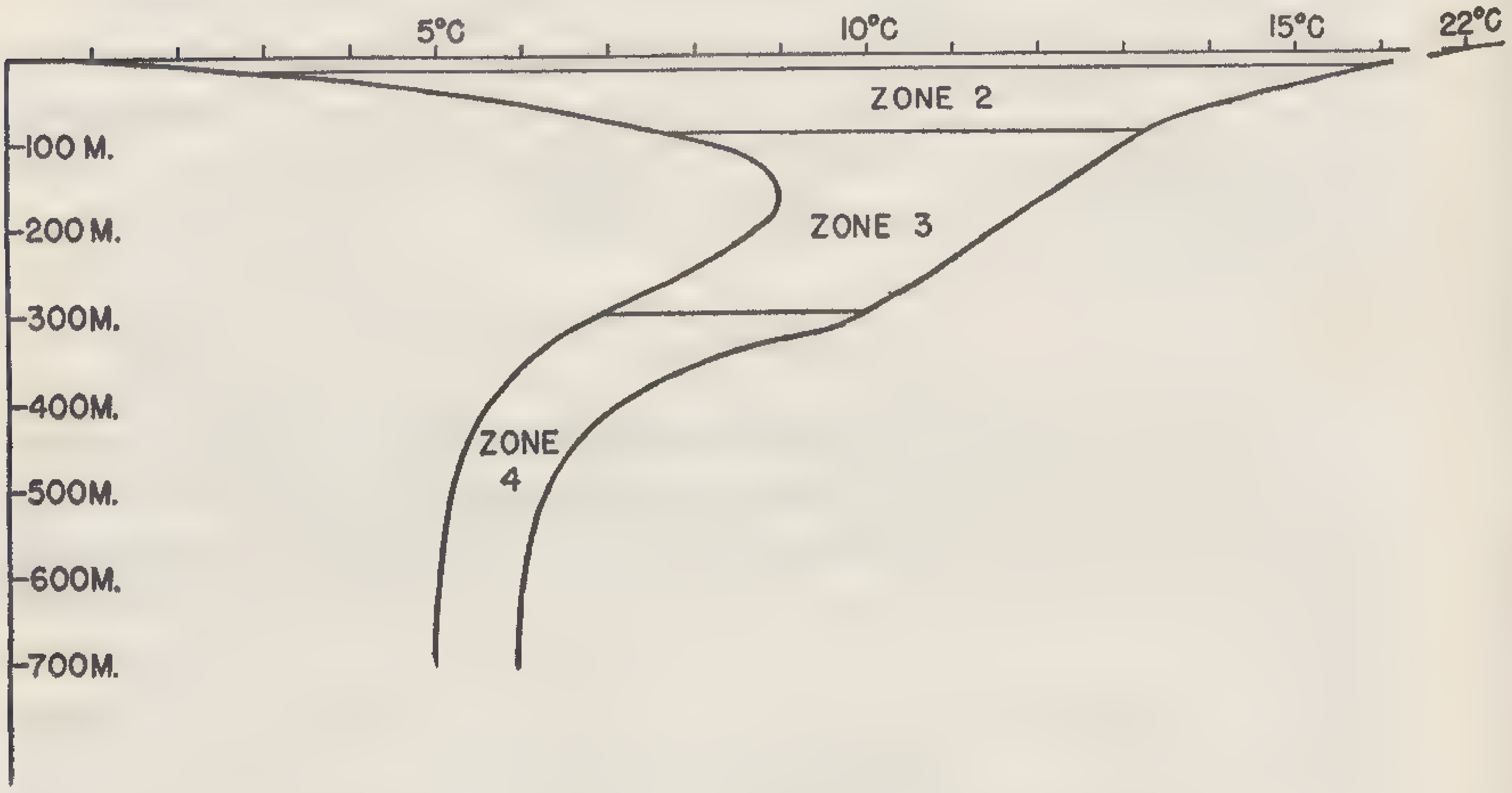

Figure 3. Maximum and minimum bottom temperatures in relation to depth on a profile running southeast from Montauk Point, Long Island.

Some interesting relationships may be found between the faunas living in the various zones and the temperatures to which they are subjected. The fauna of the first zone must be able to withstand not only very high and very low temperatures but also a high degree of temperature variation annually, which may easily account for the meager variety of species found. The second zone is subjected to a considerable variation of temperature also, although the variation is only about half as great as that found in the first zone. The minimum temperature in this zone is very low but somewhat higher than that of Zone 1. In the third zone, however, the minimum temperature is at its highest and the annual variation is not more than 5°C. This zone contains the richest fauna, both in variety of species and to a lesser extent the actual abundance of the forms. The mean temperature of the fourth zone is somewhat lower than that of the third but the annual variation is slight, amounting to only 1° or 2°C.

There are two factors to consider in dealing with the influence of temperature on the Foraminifera. The first is the actual minimum and maximum temperatures to which a fauna is exposed and to which it must adapt itself, the second is the annual variation to which the fauna is subjected, which varies to some extent in different years. It seems obvious that fewer forms could adapt themselves to a wide range of temperature than to a narrow one. It also seems probable that many forms could be acclimated to higher or lower temperatures if the annual variation were not very great. This may be true of the species which are found to occur throughout the third and fourth zones.

It is interesting to note in this connection that the forms composing the main part of the fauna in the second zone and, to a somewhat lesser extent, the first are found throughout the four zones. There can be no doubt that these species are adapted to widely varying temperature conditions. On the other hand, some explanation other than temperature conditions may be found for the occurrence of forms peculiar to the first and second zones within, of course, the temperature limits found in the area. It is possible, however, that these forms need the high temperatures of the summer months to carry on their reproductive processes. Myers (1935) found in working with *Patellina corrugata* Williamson, a species restricted to warm, shallow waters of the littoral zone, that the maximum rate of reproduction occurred at 21°C. Below 18°C reproduction was retarded and above 25°C reproduction became abnormal. These findings were made, of course, under laboratory conditions but it is probable that analogous behavior would be found in the sea. Myers adds that in the winter months few developmental stages of this species were found.

In the area east and north of Cape Cod different conditions prevail. At the depths from which the samples were taken there is complete mixing of the water in the winter months. In addition the warming of the water in the summer is not as great as that further south. In the vicinity of the Cape Cod Light traverse the bottom temperatures at 50-100 meters vary from 2°-17°C; at 100-200 meters from 4°-9°C. In water shallower than 50 meters the temperature may drop below 1°C in the winter and in the summer may be slightly higher than 17°C.[1]

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[1] These figures were obtained by the *Atlantis* on a series of cruises made in 1933 and 1934.

Similar conditions prevail in the Gulf of Maine, at least as far as the minimum temperatures are concerned, although the maximum temperatures are lower. This wide annual variation of temperatures and the low mean temperature provide what seem very adequate reasons for the absence in the Cape Cod Light traverse of the rich fauna found in Zone 3 further south. These facts also give a possible explanation of why the species found in the deeper water of this traverse are those which are common to both Zones 3 and 4 or are found only in Zone 4. The minimum temperatures encountered more closely approximate those found in Zone 4 further south, while the range of temperature variation of 6°C more nearly approximates that of Zone 3. The conditions combine, then, characteristics typical of Zones 3 and 4 in the southern area. If this explanation of the fauna found in this traverse is true, it shows that the minimum temperatures to which a fauna is subjected are of great importance. The fauna found bears more resemblance to that of the fourth zone than that of the third, although the maximum temperatures are higher and the range of temperature therefore greater.

SALINITY

Aside from localized brackish water conditions, met with in enclosed bays and near the mouths of rivers, there is comparatively little average salinity change to be met with at the bottom of the continental shelf water. The greatest variation is, of course, near shore and it becomes progressively less out to deep water. The salinities to be found at the various depths have been compiled from data given by Bigelow and Sears (1935). The values given are the maximum and minimum values that might be encountered over a period of years.

20 meters	31.4–33.6 o/oo
30–60 meters	32.3–33.6 o/oo
60–100 meters	32.8–34.6 o/oo
100–240 meters	34.6–35.5 o/oo
300 meters	34.9–35.7 o/oo

Whether these variations are large enough to affect the fauna can be a matter of speculation only at the present time. Zone 2 is subjected to a variation of 3.2 o/oo with a mean value of 33 o/oo; Zone 3 to a variation of 1.1 o/oo with a mean value of 35.2 o/oo. In Zone 4 the values are close to 35 o/oo.

Owing to the close relationship between temperature and salinity, it is impossible to determine which is the more important influence on the fauna or whether, as is more probable, it is the combination of the two which is effective. Laboratory experimentation is probably needed for the solution of this problem.

FOOD SUPPLY

At the present time nothing of importance can be said concerning the nutrition of the Foraminifera as it relates to this problem. They are generally supposed to subsist on diatoms, algae, and other vegetable matter. There can be no doubt that at different times of year food of this sort is more scarce on the continental shelf than at others. Whether the relative scarcity of the supply would materially affect the Foraminifera cannot be said until further work on the living organisms has been done.

ABUNDANCE OF SPECIMENS

There is no apparent explanation of the great variations in the number of Foraminifera found in the samples. It was thought that there might be some correlation between the type of bottom sediment and the abundance of the Foraminifera. Such does not appear to be the case, however. Abundance curves were drawn and compared with the percentage curves of clay, silt, and colloid in various traverses. There is no apparent correlation. Neither is there any significant relationship between the abundance curves of the Foraminifera and the relative percentages of gravel and sand. In general it may be said that there is an increase in the abundance of Foraminifera from the shallow water to the deeper. In the samples taken in less than 50 meters the total abundance was very low, being less than 0.1 cc. of Foraminifera to 100 cc. of raw material. This may be due in part to the scouring of longshore currents. It has been found that wave action does not materially affect the sediments beyond the 70 meter depth, and this fact may have considerable bearing on abundance. Another generalization that may be made is that the Foraminifera seem to be more abundant in the warmer areas. The samples in Zone 3 are richer on the average than those of other zones, although even here unexplained fluctuations take place.

It is possible that there are various mechanical agencies at work causing localization of rich and poor areas. Sorting mechanisms must act on the dead tests of Foraminifera as well as on the inorganic sediments. The rate of sedimentation may also vary. An argument in favor of the action of some sort of mechanical agency is that the relative percentages of planktonic and benthonic Foraminifera remain the same, or at least maintain their relative relationships in view of their position on the continental shelf, regardless of whether the sample has a relatively large or small number of organisms in it. If the abundance of Foraminifera in a sample were due to some cause other than mechanical sorting or the differential rate of sedimentation one would expect a change of ratio between planktonic and benthonic faunas as they are not affected by the same local environmental conditions.

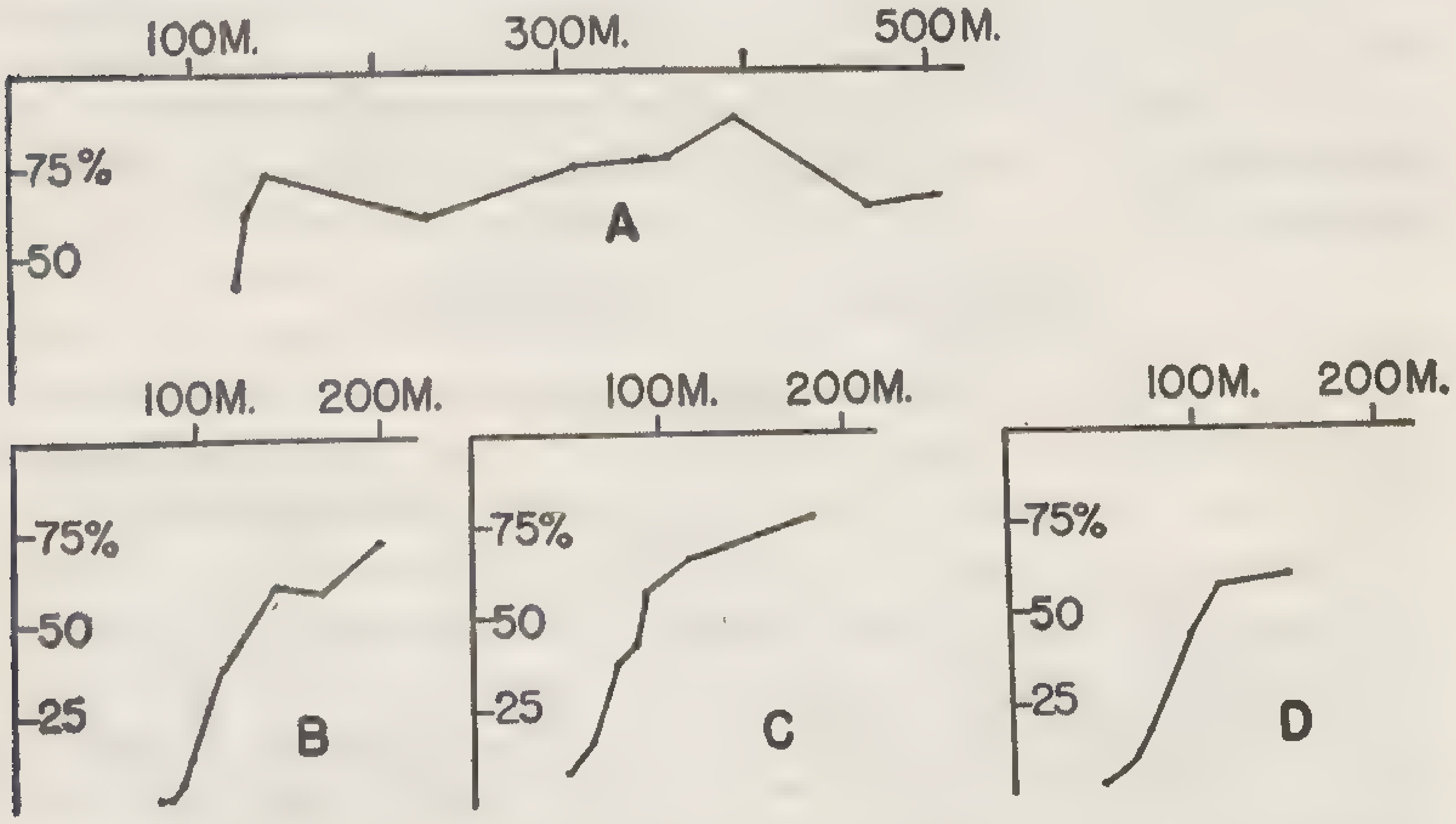

Figure 4. Relative abundance of planktonic Foraminifera in relation to depth.
A. Marthas Vineyard traverse
B. Block Island traverse
C. New Jersey traverse
D. Maryland traverse

PLANKTONIC FORAMINIFERA

The planktonic Foraminifera are confined almost entirely to the area south of Cape Cod. They appear in the four deepest samples of the Cape Cod Light traverse where they form 2.6% of the fauna at 121 meters increasing to 19.6% at 144 meters and decreasing again to 11.3% at 203 meters. At the latter station the actual abundance is almost three times that of the 144 meter station. The planktonic fauna in these samples is composed almost entirely of *Globigerina eggeri* *v.* Rhumbler. The only other occurrence of planktonic forms in the northern area is in the shallowest sample of this traverse at a depth of ½ meter. This is the sample which was mentioned earlier as containing an alien fauna probably brought from the south by longshore currents. All the planktonic specimens in this traverse were much smaller than the normal adult specimens of the southern area. No planktonic Foraminifera were found in the Ipswich Bay traverse.

A study of the curves plotted to show the relative proportions of planktonic to benthonic specimens in the area south of Cape Cod shows that in water of less than 50 meters in depth the planktonic forms are practically negligible. It should be said here that this method of measuring the relative abundance of the planktonic forms has flaws due to the fluctuations of the benthonic fauna. It was found, however, as has been mentioned previously, that the total abundance of the planktonic forms varied between samples very much as did the benthonic. A study of the tables listing the planktonic fauna will reveal these fluctuations in the abundance, and a comparison may be made with those of the benthonic forms. For this reason the representation on the chart of the relative percentages of the planktonic to benthonic forms seems to be the most trustworthy method of presenting the facts. The introduction of depth also, is, in itself, irrelevant, but as a means of fixing the areal limits of the organisms it is useful. From the 50 meter point outward there is a rapid increase in the relative percentage of planktonic forms until at the break in slope, or slightly deeper, they form as high as 80% of the Foraminifera found. In the Marthas Vineyard traverse, which extends farther out onto the slope than the others, the percentages dropped somewhat in the two deepest samples after reaching a maximum of 80% at 393 meters. This may show that this is the inner limit of the environment that is favorable for the planktonic fauna found in the western North Atlantic. A continued increase outward, on the other hand, would show that conditions were still on the border line, being favorable, perhaps, only at certain times of year.

In the southern region there are fifteen species which are present in sufficient quantities to be given a percentage rating. Of these, three species of *Globigerina* form the bulk. They are, in order of importance: *Globigerina eggeri* Rhumbler, *Globigerina bulloides* d'Orbigny, and *Globigerina inflata* d'Orbigny. It is possible that the forms included under the name *Globigerina eggeri* are of more than one species. Many of the specimens are very small but they closely resemble the large, well-developed form that may definitely be assigned to that species. *Globigerina inflata* maintains a fairly constant percentage of the samples but *Globigerina eggeri* increases somewhat with distance from the shore while *Globigerina bulloides* decreases. The remaining twelve species are present in very small relative quantities and are very spotty in occurrence. It is interesting to note that the specimens of *Globigerinoides rubra* (d'Orbigny) found lack the rosy color typical of those occurring south of Cape Hatteras.

Sir John Murray in a discussion of planktonic Foraminifera (1897) says that on the *Challenger* expedition the dead tests were never found at the bottom when the living forms were absent from the plankton. For this reason he believed that the rate of fall to the bottom after death was rapid. He accounts for the disappearance of the planktonic forms at the edge of the continental shelf on the basis of changing temperature conditions. It seems equally probable that salinity change may play an important part. In the coastal waters the salinity is lowest on the surface and increases with depth, while the reverse is true in deep water. In addition, the relatively fresh coastal waters are at most times less dense than the corresponding layer offshore so that a current is maintained which tends to have its greatest strength just outside the 100 fathom curve (Iselin, 1939). Small scale mixing processes at this point result in a rapidly changing temperature-salinity correlation across the boundary. It is across this boundary also that the relative abundance of planktonic Foraminifera decreases rapidly shoreward. Whether this decrease is due to the physical characteristics of the water or to the mechanical difficulty of the transportation of the forms nearer shore is open to question.

CONCLUSIONS

(1) Evidence of four definite faunal zones running parallel to the coast from Cape Cod to Maryland has been found. Definite zones east and north of Cape Cod could not be established due probably to the complete mixing of the water in winter, lower temperatures throughout the year, and the great annual variation of temperature.

(2) An analysis of the various physical conditions points to the probability that temperature is the chief controlling factor in the distribution of the Foraminifera in this area. Light, salinity, and food supply probably exert control also.

(3) No reason for the varying abundance of the Foraminifera was found, though the abundance increases to some extent with depth. Mechanical agencies such as differential rate of sedimentation or transportation of the tests may cause localized differences in abundance.

(4) The planktonic fauna is confined almost entirely to the region south of Cape Cod, with the greatest abundance at about 400 meters. Temperature and salinity changes appear to be the main factors which cause the disappearance of the planktonic Foraminifera shoreward from this point.

SPECIES REFERRED TO IN TEXT AND TABLES

Ammodiscus sp. (Pl. 1, fig. 6)
Ammosphaeroidina sphaeroidiniformis (H. B. Brady) (Pl. 4, fig. 3)
Angulogerina angulosa (Williamson) (Pl. 5, fig. 21)
Angulogerina angulosa (Williamson) var. (Pl. 4, fig. 12)
Angulogerina sp. 1. (Pl. 1, fig. 14)
Angulogerina sp. 2. (Pl. 5, fig. 22)
Astrononion stellatum Cushman and Edwards (Pl. 5, fig. 6)

Bolivina pseudoplicata Heron-Allen and Earland (Pl. 1, fig. 13)
Bolivina subaenariensis Cushman (Pl. 5, fig. 17)
Bolivina subspinescens Cushman (Pl. 4, fig. 8)
Bolivina sp. 1. (Pl. 5, fig. 16)
Bolivina sp. 2. (Pl. 5, fig. 18)
Bulimina aculeata d'Orbigny (Pl. 5, fig. 12)
Bulimina (Desinobulimina) auriculata Bailey (Pl. 5, fig. 9)
Bulimina exilis (H. B. Brady) (Pl. 4, fig. 9)
Bulimina marginata d'Orbigny (Pl. 5, fig. 11)
Bulimina marginata d'Orbigny var. (Pl. 4, fig. 10)
Bulimina (Desinobulimina) turgida Bailey (Pl. 5, fig. 10)
Bulimina sp. (Pl. 5, fig. 13)
Buliminella elegantissima (d'Orbigny) (not figured)

Cancris sagra (d'Orbigny) (Pl. 3, figs. 11 a, b)
Cassidulina crassa d'Orbigny (Pl. 6, figs. 5 a, b)
Cassidulina laevigata d'Orbigny (Pl. 6, fig. 4)
Cassidulina norcrossi Cushman (Pl. 6, figs. 2 a, b)
Cassidulina subglobosa H. B. Brady (Pl. 6, figs. 3 a, b)
Cassidulina sp. (Pl. 6, figs. 6 a, b)
Cassidulinoides bradyi (Norman) (Pl. 3, fig. 12)
Chilostomella ovoidea Reuss (Pl. 3, fig. 15)
Cibicides concentrica (Cushman) (Pl. 1, figs. 16 a, b)
Cibicides pseudoungeriana (Cushman) (Pl. 6, figs. 7 a, b)
Cibicides refulgens (Montfort) (Pl. 6, figs. 10 a, b) [1]

Dentalina advena (Cushman) (not figured)
Dentalina filiformis (d'Orbigny) (not figured)
Dentalina mucronata (Neugeboren) (Pl. 5, fig. 1)

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[1] *Cibicides lobatulus* (Walker and Jacob) is included with this species.

Discorbis bertheloti (d'Orbigny) (Pl. 3, figs. 5 a, b)
Discorbis floridana Cushman (Pl. 5, figs. 23 a, b)
Discorbis obtusa d'Orbigny (Pl. 5, figs. 24 a, b)
Discorbis sp. 1. (not figured)
Discorbis sp. 2. (Pl. 1, fig. 15)
Discorbis sp. 3. (not figured)

Eggerella advena Cushman (Pl. 1, fig. 2)
Elphidium incertum (Williamson) (Pl. 5, fig. 7)
Elphidium subarcticum Cashman (Pl. 5, fig. 4)
Elphidium sp. (Pl. 1, fig. 12)
Entosolenia (several species, not figured)
Epistomina elegans (d'Orbigny) (Pl. 3, fig. 9)
Eponides frigida (Cushman) var. *calida* Cushman and Cole (Pl. 5, figs. 25 a, b)
Eponides umbonata (Reuss) (Pl. 6, figs. 1 a, b)
Eponides umbonata (Reuss) var. *ehrenbergi* (Bailey) (Pl. 3, figs. 16 a, b)
Eponides sp. (Pl. 3, figs. 13 a, b)

Gaudryina (*Pseudogaudryina*) *atlantica* (Bailey) (Pl. 2, fig. 3)
Globigerina bulloides d'Orbigny (Pl. 7, figs. 1, 2)
Globigerina eggeri Rhumbler (Pl. 7, figs. 5, 6)
Globigerina inflata d'Orbigny (Pl. 6, figs. 12, 13)
Globigerinella aequilateralis (H. B. Brady) (Rare — planktonic, not figured)
Globigerinoides conglobata (H. B. Brady) (Pl. 7, figs. 8, 9)
Globigerinoides rubra (d'Orbigny) (Pl. 7, fig. 4)
Globigerinoides sacculifera (H. B. Brady) (Pl. 7, fig. 7)
Globorotalia hirsuta (d'Orbigny) (Pl. 7, figs. 11, 14)
Globorotalia menardii (d'Orbigny) (Pl. 7, fig. 10)
Globorotalia truncatulinoides (d'Orbigny) (Pl. 7, figs. 12, 15)
Globorotalia tumida (H. B. Brady) (Pl. 7, figs. 16, 17)
Globulina inaequalis Reuss (Pl. 1, fig. 8)
Globulina inaequalis Reuss var. *caribaea* d'Orbigny (Pl. 1, fig. 10)
Guttulina lactea (Walker and Jacob) (Pl. 5, fig. 3)
Guttulina sp. (not figured)
Gyroidina orbicularis d'Orbigny (Pl. 4, figs. 14 a, b)
Gyroidina soldanii d'Orbigny (Pl. 3, figs. 8 a, b)

Haplophragmoides columbiensis Cushman (Pl. 4, fig. 17)
Haplophragmoides glomeratum (H. B. Brady) (Pl. 4, fig. 16)
Haplophragmoides major Cushman (Pl. 1, fig. 1)
Haplophragmoides subglobosum (G. O. Sars) (Pl. 4, fig. 18)
Haplophragmoides sp. (Pl. 4, fig. 20)

Karreriella affinis (Fornasini) (Pl. 2, fig. 7)
Karreriella bradyi (Cushman) (Pl. 4, fig. 5)
Karreriella (?) sp. (not figured)

Lagena hexagona (Williamson) (Pl. 4, fig. 19)
Lagena laevis (Montagu) var. *nebulosa* Cushman (Pl. 4, fig. 24)
Lagena torquata H. B. Brady (Pl. 4, fig. 23)
Lenticulina peregrina (Schwager) (Pl. 4, fig. 25)
Listerella nodulosa (Cushman) (Pl. 4, fig. 4)

Marginulina bacheii Bailey (Pl. 3, fig. 1)
Massilina sp. (Pl. 2, fig. 8)

Nodosaria pyrula d'Orbigny (Pl. 5, fig. 2)
Nonion cf. *barleeanum* (Williamson) (Pl. 3, fig. 3)
Nonion grateloupi (d'Orbigny) (Pl. 3, fig. 4)
Nonion grateloupi (d'Orbigny) var. (Pl. 4, fig. 7)
Nonion labradoricum (Dawson) (Pl. 5, fig. 5)
Nonion sloanii (d'Orbigny) (Pl. 1, fig. 11)
Nonionella turgida (Williamson) (Pl. 3, figs. 6 a, b)

Orbulina universa d'Orbigny (Pl. 6, fig. 11)

Planulina foveolata (H. B. Brady) (Pl. 3, figs. 17 a, b)
Planulina mera Cushman (Pl. 6, figs. 9 a, b)
Plectina apicularis (Cushman) (Pl. 2, fig. 6)
Poroeponides lateralis (Terquem) (Pl. 1, figs. 17 a, b)
Proteonina difflugiformis (H. B. Brady) (Pl. 4, fig. 15)
Pseudoclavulina novangliae (Cushman) (Pl. 2, fig. 14)
Pseudoglandulina occidentalis (Cushman) (Pl. 4, fig. 6)
Pseudopolymorphina atlantica Cushman and Ozawa (Pl. 3, fig. 2)
Pullenia quinqueloba (Reuss) (Pl. 6, fig. 8)
Pulleniatina obliquiloculata (Parker and Jones) (Pl. 7, fig. 13)
Pulvinulinella cf. *exigua* (H. B. Brady) (Pl. 3, fig. 14)
Pyrgo cf. *denticulata* (H. B. Brady) (Pl. 2, fig. 9)
Pyrgo elongata (d'Orbigny) (not figured)
Pyrgo striatella (Cushman) (Pl. 1, fig. 9)
Pyrgo subsphaerica (d'Orbigny) (Pl. 2, fig. 10)

Quinqueloculina seminulum (Linnaeus) (Pl. 1, figs. 3 a, b)
Quinqueloculina seminulum (Linnaeus) var. *jugosa* Cushman (Pl. 1, fig. 5)

Robertina arctica d'Orbigny (Pl. 5, fig. 8)
Robertina sp. (Pl. 3, fig. 7)
Robulus sp. 1. (Pl. 2, fig. 12)
Robulus sp. 2. (Pl. 2, fig. 13)
Robulus sp. 3. (Pl. 2, fig. 11)

Sigmoilina schlumbergeri Silvestri (not figured)
Sphaeroidina bulloides d'Orbigny (Pl. 7, fig. 3)
Sphaeroidinella dehiscens (Parker and Jones) (rare planktonic, not figured)
Spiroplectammina sp. (Pl. 4, fig. 21)

Textularia candeiana d'Orbigny (Pl. 2, fig. 5)
Textularia goessi Cushman (?) (Pl. 2, fig. 1)
Textularia pseudotrochus Cushman (Pl. 2, fig. 2)
Triloculina tricarinata d'Orbigny (not figured)
Triloculina sp. (Pl. 1, figs. 4 a, b)
Trochammina globigeriniformis (Parker and Jones) (Pl. 2, fig. 4)
Trochammina globulosa Cushman (Pl. 4, figs. 22 a, b)
Trochammina lobata Cushman (Pl. 1, figs. 7 a, b)
Trochammina ochracea (Williamson) (not figured)
Trochammina sp. (not figured)

Uvigerina peregrina Cushman (Pl. 4, fig. 11)
Uvigerina peregrina Cushman var. *bradyana* Cushman (Pl. 5, fig. 20)
Uvigerina sp. (Pl. 5, fig. 19)

Valvulina conica Parker and Jones (Pl. 4, figs. 1, 2)
Valvulineria sp. (Pl. 4, figs. 13 a, b)
Virgulina compressa (Bailey) (Pl. 3, fig. 10)
Virgulina fusiformis Williamson (Pl. 5, fig. 15)
Virgulina sp. (Pl. 5, fig. 14)

BIBLIOGRAPHY

Bigelow, H. B.

1933. *Studies of waters on the continental shelf, Cape Cod to Chesapeake Bay, I. Cycle of temperature.* Papers in Physical Oceanography and Meteorology publ. by Mass. Inst. Technol. and Woods Hole Oceanogr. Inst., **2**, no. 4, pp. 3–135.

Bigelow, H. B. and Sears, M.

1935. *Studies of the waters on the continental shelf, Cape Cod to Chesapeake Bay, II. Salinity.* Papers in Physical Oceanography and Meteorology publ. by Mass. Inst. Technol. and Woods Hole Oceanogr. Inst., **4**, no. 1, pp. 3–94.

Clarke, G. L.

1936. *Light penetration in the western North Atlantic and its application to biological problems.* Rapp. et Proc. Verb. Cons. Perm. Internat. Exp. Mer., **101**, pt. 2(3), pp. 3–14.

——1939. *Variation in the transparency of three areas of the Atlantic throughout the year.* Ecology, **20**, no. 4, pp. 529–543.

Cushman, J. A.

1918–1931. *Foraminifera of the Atlantic Ocean.* U. S. Nat. Mus. Bull. 104, pts. 1–8.

——1940. *Foraminifera; their classification and economic use,* 3rd. ed. Harvard University Press.

Iselin, C. O'D.

1939. *Some physical factors which may influence the productivity of New England's coastal waters.* Sear's Found. Jour. of Marine Res., **2**, no. 1, pp. 74–85.

Murray, J.

1897. *On the distribution of pelagic Foraminifera at the surface and on the floor of the Ocean,* Nat. Sci., pp. 17–27.

Myers, E. H.

1935. *The life history of Patellina corrugata Williamson, a Foraminifer.* Scripps Inst. Oceanogr. Bull., Tech. ser. **3**, no. 15, pp. 355–392.

Phleger, F. B

1942. *Foraminifera of submarine cores from the continental slope, part 2.* Geol. Soc. Am., Bull. 53, pp. 1073–1098.

Stetson, H. C.

1938. *The sediments of the continental shelf off the eastern coast of the United States,* Papers in Physical Oceanography and Meteorology, publ. by Mass. Inst. Technol. and Woods Hole Oceanogr. Inst., **5**, no. 4, pp. 5–48.

TABLE 1. PERCENTAGE DISTRIBUTION OF THE BENTHONIC FORAMINIFERA IN THE MARYLAND TRAVERSE

Atlantis Station	1236a	1236d	1237b	1237d	1237f	1238a	1238c	1238e	1238h	1239a	1239c	1239d	1239e	1239f	1240a
Position	38° 12′ N 75° 02′ W	—	—	—	—	38° 02′ N 74° 37′ W	—	—	—	37° 55′ N 74° 20′ W	—	—	—	—	37° 49′ N 74° 07′ W
Distance from starting point (nautical miles)	—	5.7	11.4	15.2	19	22.6	26.0	29.4	34.5	36.5	40.5	42.5	44.5	46.5	
Depth (meters)	22	24.5	32	22	35	37	44	52	63	68	77	99	114	154	386
Proteonina difflugiformis			0.9		2.5	4.7	2.7	1.7	2.2	3.1	1.9	0.5	0.5		
Pseudoclavulina novangliae														0.1	
Eggerella advena		0.5			7.7			1.7	0.8	0.8	0.6	0.3			
Listerella nodulosa															1.9
Quinqueloculina seminulum	6.3	2.9	2.9	4.7	13.6	3.4	15.3	1.0							
Quinqueloculina seminulum var. jugosa			0.8	1.6											
Massilina sp.													0.5	0.1	
Triloculina sp.								1.5	1.2	1.3	1.1	0.6	0.2		
Pyrgo elongata													0.2		
Pyrgo striatella									0.3	0.2	0.2				
Pyrgo cf. denticulata												0.4			
Trochammina lobata	0.6	0.7	1.2				1.6	0.4	0.3	0.3					
Robulus sp. 2										0.4	0.7	1.3	0.7	3.3	
Robulus sp. 3												0.3		0.4	
Marginulina bacheii										0.1	0.7	2.5	1.1	0.4	
Nodosaria pyrula														0.1	
Lagena hexagona													0.2	0.3	
Lagena laevis var. nebulosa														0.1	
Miscellaneous Lagena												0.3	0.3	0.3	
Miscellaneous Lagenidae									0.8	0.5	0.7	0.7	0.7	0.7	1.1
Globulina inaequalis									0.6	0.2					
Globulina inaequalis var. caribaea						2.0	2.2	0.6	0.3	0.4	0.4	0.2			
Guttulina lactea			2.4		2.0	1.4	1.6	1.5	2.6	2.2	1.1	0.9	0.3	0.2	
Nonion sloanii								0.4	0.2						
Nonion cf. barleeanum												0.2	0.3	0.1	
Nonion labradoricum													0.2	0.1	
Nonion grateloupi													0.1	0.3	
Nonionella turgida													0.3	0.2	
Elphidium incertum	77.6	65.4	68.6	65.6	39.9	31.1	28.6	37.5	29.3	21.5	12.5	9.7	8.1	5.8	18.2
Elphidium sp.	5.0	9.6	4.8	3.1	2.2										
Elphidium subarcticum	3.3	1.8	3.6	4.7	4.7	3.4	7.7	22.2	22.6	22.8	19.1	13.2	6.0	0.5	1.2
Buliminella elegantissima		1.8													
Bulimina (Desinobulimina) turgida														0.2	
Bulimina (Desinobulimina) auriculata														0.3	
Bulimina marginata		0.3				4.1		0.3	2.2	2.5	7.4	16.7	23.1	21.9	39.3
Bulimina marginata var.															0.4
Bulimina sp.									0.3	0.3	0.4	0.2	0.4		

Atlantis Station	*1236a*	*1236d*	*1237b*	*1237d*	*1237f*	*1238a*	*1238c*	*1238e*	*1238h*	*1239a*	*1239c*	*1239d*	*1239e*	*1239f*	*1240a*
Position	38° 12′ N 75° 02′ W	—	—	—	—	38° 02′ N 74° 37′ W	—	—	—	37° 55′ N 74° 20′ W	—	—	—	—	37° 49′ N 74° 07′ W
Distance from starting point (nautical miles)	—	5.7	11.4	15.2	19	22.6	26.0	29.4	34.5	36.5	40.5	42.5	44.5	46.5	
Depth (meters)	22	24.5	32	22	35	37	44	52	63	68	77	99	114	154	386
Virgulina fusiformis		0.8			1.5			2.4		0.2	0.5	1.0	2.0	5.5	
Virgulina sp.						6.1				0.3	0.2	0.9	1.1	1.3	0.4
Virgulina compressa													0.1	0.6	
Bolivina sp. 1		0.9				2.7				0.2	0.1	0.6	2.3	13.0	6.2
Bolivina pseudoplicata		0.8			2.2	4.1		1.3	0.6	0.7	0.3	0.4	0.5	0.4	
Bolivina sp. 2														0.4	
Bolivina subaenariensis													0.2	1.4	0.2
Uvigerina sp.													0.1	4.1	1.8
Uvigerina peregrina var. bradyana												0.2	0.3	0.9	1.0
Angulogerina angulosa									0.7	0.8	1.7	5.5	8.1	7.1	10.3
Entosolenia												0.1	0.5	0.4	
Discorbis sp. 2		1.6	1.2												
Discorbis floridana		4.3	0.5		2.7			0.2	0.2	0.4	0.8	0.9	1.3	0.3	
Discorbis obtusa								0.4	0.2	0.2		0.3			
Gyroidina orbicularis															0.1
Epondes frigida var. calida	1.3	0.7	0.5					0.6	0.5	0.5	0.1	1.2	1.6	0.6	1.5
Eponides sp.													0.5	0.6	
Eponides umbonata														0.2	0.4
Canceris sagra												0.1			
Pulvinulinella cf. exigua												0.7	1.5	1.0	
Epistomina elegans												0.2	0.2	1.0	
Cassidulina subgobosa						6.7		0.4	0.6	1.0	5.7	10.6	11.6	5.3	5.7
Cassidulina norcrossi												0.4	1.1	1.9	6.2
Cassidulina laevigata												1.5	2.7	4.2	1.7
Cassidulina sp.												0.5	0.6	1.7	0.4
Cassidulina crassa													1.0	2.0	0.4
Cassidulinoides bradyi														0.6	
Pullenia quinqueloba														0.3	
Cibicides concentrica	2.1	2.6	3.6	3.1	2.0	4.1	16.5	2.9	0.6	0.2					
Planulina mera		0.6	3.8	6.3	5.4	4.7	9.9	4.5	0.8	0.7	1.0	1.2	1.1	1.2	
Cibicides pseudoungeriana									0.8	1.8	3.1	7.1	8.1	4.2	0.2
Cibicides refulgens	0.9				1.5	6.1	6.6	17.4	30.6	35.8	38.6	17.3	7.9	2.7	0.6
Planulina foveolata												0.2	0.8	0.8	
Miscellaneous	2.9	4.8	5.1	10.9	12.1	15.5	7.1	1.2	0.8	0.8	1.0	1.2	1.7	0.9	0.7
Estimated number of specimens	850	1350	600	75	400	150	200	6100	13500	17250	11700	63200	58800	425700	106000

Table 2. Percentage Distribution of the benthonic Foraminifera in the New Jersey traverse

Atlantis Station	1245a	1244c	1244a	1243f	1243d	1243b	1242f	1242d	1242c	1242b	1242a	1241c	1241b
Position	39° 14′ N 73° 54′ W	—	39° 07′ N 73° 43′ W	—	—	—	—	—	—	—	38° 47′ N 73° 06′ W	—	—
Distance from starting point (nautical miles)	—	5.4	10.7	15.9	21.1	26.3	32.3	38.3	41.3	44.3	46.7	49.1	51.5
Depth (meters)	45.5	36	43	53	53	66	74	77	82	90	117.7	182	610
Proteonina difflugiformis	20.5	10.4	4.8	6.1	4.9	7.2	2.9						2.9
Pseudoclavulina novangliae											0.4	0.5	
Gaudryina (Pseudogaudryina) atlantica												0.8	
Eggerella advena	6.7	12.4		3.8	3.6	6.8	1.8						
Listerella nodulosa													2.3
Valvulina conica													0.7
Quinqueloculina seminulum	1.2	11.9	11.1										
Massilina sp.											0.5		
Triloculina sp.	1.7	1.0	4.8		2.8	1.1	0.6	0.6					
Trochammina lobata	1.9			0.6		0.7							
Robulus sp. 1											0.3	0.6	
Robulus sp. 2										1.2	1.3	1.5	
Marginulina bacheii											1.5	0.8	
Dentalina advena											0.1		
Dentalina mucronata												0.3	
Dentalina filiformis												0.1	
Miscellaneous Lagena												0.8	
Miscellaneous Lagenidae								1.4	1.6	5.1	1.5	2.0	1.7
Globulina inaequalis			1.6										
Globulina inaequalis var. caribaea		1.0	4.8										
Guttulina lactea	2.6	3.6	20.6	0.7		1.7	0.6			1.5	0.2		
Nonion labradoricum													0.8
Nonion grateloupi											0.3		
Nonionella turgida											0.2		
Elphidium incertum	40.4	30.1	17.5	48.2	11.3	13.9	26.1	3.8	2.7	0.6	0.4	1.5	11.4
Elphidium subarcticum	12.0	5.2	7.9	5.3	4.9	11.3	5.3	3.8	13.0	9.8	0.4		
Bulimina marginata						1.0	18.8	17.4	20.4	10.7	11.6	7.8	11.1
Bulimina marginata var.													10.6
Bulimina (Desinobulimina) turgida											0.3	0.9	2.0
Bulimina exilis													4.4
Virgulina fusiformis	1.4			0.6				1.8	1.5	1.4	2.4	0.7	1.1
Virgulina sp.							1.0						2.3

Atlantis Station	*1245a*	*1244c*	*1244a*	*1243f*	*1243d*	*1243b*	*1242f*	*1242d*	*1242c*	*1242b*	*1242a*	*1241c*	*1241b*
Position	39° 14′ N 73° 54′ W	—	39° 07′ N 73° 43′ W	—	—	—	—	—	—	—	38° 47′ N 73° 06′ W	—	—
Distance from starting point (nautical miles)	—	5.4	10.7	15.9	21.1	26.3	32.3	38.3	41.3	44.3	46.7	49.1	51.5
Depth (meters)	45.5	36	43	53	53	66	74	77	82	90	117.7	182	610
Virgulina compressa											0.2	0.8	
Bolivina sp. 1	0.6	7.8						0.7	1.1		2.9	6.5	12.8
Bolivina pseudoplicata	2.0	2.1		1.5									
Bolivina subaenariensis											0.4	0.6	0.9
Uvigerina sp.											0.7	1.0	0.9
Uvigerina peregrina var. bradyana											0.9	0.8	0.5
Angulogerina sp. 1	0.3												
Angulogerina angulosa							1.7	4.5	7.1	9.1	24.7	7.5	1.0
Angulogerina angulosa var.													0.4
Discorbis floridana								0.7		1.8	0.9		
Gyroidina soldanii												1.7	
Gyroidina orbicularis													0.2
Eponides frigida var. calida	1.5	1.0		0.6			2.6						
Eponides umbonata var. ehrenbergi												0.5	
Valvulineria sp.													1.1
Epistomina elegans											2.0	2.3	
Cassidulina subglobosa		1.6					2.1	14.6	14.8	9.4	8.5	7.8	2.0
Cassidulina norcrossi							0.2				1.2		14.3
Cassidulina laevigata								1.3	1.1		3.2	9.9	3.2
Cassidulina sp.											1.9	8.1	
Cassidulina crassa											5.4	10.1	1.1
Cassidulinoides bradyi												0.5	
Pullenia quinqueloba													1.3
Cibicides pseudoungeriana							1.5	5.0	6.8	21.6	17.5	11.5	1.7
Cibicides refulgens	2.0	7.3	27.0	31.2	67.8	54.1	31.8	39.0	24.7	20.3	2.8	4.8	1.9
Cibicides concentrica	2.6	1.0											
Planulina mera	1.1												
Planulina foveolata											1.9	2.8	
Miscellaneous	1.6	3.6		1.6	4.9	2.3	2.9	5.2	5.3	7.5	3.5	4.3	5.5
Estimated number of specimens	2300	200	100	11300	700	5900	14900	4900	3100	4400	140500	107000	5800

TABLE 3. PERCENTAGE DISTRIBUTION OF THE BENTHONIC FORAMINIFERA IN THE BLOCK ISLAND TRAVERSE

Sample	2	5	9	13	15	21	25	31	36	39	43	46	49	49a	50	52
Distance from starting point (miles)	1	4	8⅕	13⅗	21	29⅗	34⅘	41	47⅕	50⅗	55⅘	59	62	63	65	67
Depth (meters)	19	43	43	55	67½	71	70	81	80	85	93	97	112	142	167	200
Proteonina difflugiformis		25.1	3.2	15.9	60.6	78.7	60.4	47.6	17.0	9.3	0.5					
Haplophragmoides major					0.8	0.9		0.8								
Textularia goessi (?)											0.3	0.4	0.1			
Gaudryina (Pseudogaudryina) atlantica												0.4	1.6	2.0	1.2	4.0
Pseudoclavulina novangliae											1.0	2.5	4.6	2.1	2.0	2.2
Eggerella advena		21.4	16.0	57.2	14.7	4.9	3.9	6.5	2.4							
Plectina apicularis											0.3					
Quinqueloculina seminulum	7.5	4.5	5.3													
Massilina sp.												0.2		0.1		
Triloculina sp.		5.9	9.6													
Pyrgo cf. denticulata												0.2				
Trochammina lobata				1.4												
Robulus sp. 1												0.4	0.9	0.4	1.0	1.9
Robulus sp. 2									0.6	0.5	1.4	1.6	5.8	1.2	0.9	1.9
Robulus sp. 3															0.5	0.4
Marginulina bacheii											2.0	6.6	11.6	1.6	0.8	0.6
Lenticulina peregrina														0.1	0.1	0.2
Dentalina mucronata													0.4	0.1	0.3	0.7
Misc. Lagenidae									1.0	0.7	0.3	1.0	1.4	1.6	0.9	2.0
Guttulina lactea		3.7	5.3										0.5			
Globulina inaequalis var. caribaea			4.3													
Nonion cf. barleeanum													0.2	0.4	0.2	
Nonion labradoricum													0.2	0.2	0.1	
Nonion grateloupi														0.1	0.1	
Nonionella turgida												0.3	0.2	0.3	0.3	0.3
Elphidium incertum		16.3	25.3	12.2	12.7	10.4	23.1	30.0	39.7	47.0	22.4	5.1	0.5	1.3	0.5	1.5
Elphidium subarcticum	0.8	10.0	9.6	0.3											0.4	
Bulimina aculeata	2.0															
Bulimina (Desinobulimina) turgida											0.6	1.4	3.2	2.8	1.6	3.4
Bulimina (Desinobulimina) auriculata								1.0	7.6	7.3	2.3	0.6	0.3			

Sample	*2*	*5*	*9*	*13*	*15*	*21*	*25*	*31*	*36*	*39*	*43*	*46*	*49*	*49a*	*50*	*52*
Distance from starting point (miles)	1	4	8⅕	13⅗	21	29⅗	34⅘	41	47⅕	50⅗	55⅘	59	62	63	65	67
Depth (meters)	19	43	43	55	67½	71	70	81	80	85	93	97	112	142	167	200
Bulimina marginata			2.1		0.8	1.0	3.8	1.8	14.9	18.0	52.4	62.0	35.0	27.0	21.8	11.2
Virgulina compressa												0.4	0.4	1.8	3.0	1.3
Virgulina fusiformis									0.4	0.5	0.4	0.7		0.4	0.3	0.2
Virgulina sp.					1.1			1.0	0.5	0.3		0.4				
Bolivina pseudoplicata		1.5	2.1													
Bolivina sp. 1												1.3	0.7	2.3	3.6	3.2
Uvigerina sp.													0.8	0.9	0.4	
Uvigerina peregrina var. bradyana										0.9	2.3	3.1	7.1	2.7	1.5	0.2
Angulogerina angulosa							0.8	0.7	1.0	0.5	1.3	3.4	5.6	14.9	13.3	26.7
Discorbis floridana	5.3	1.5														
Discorbis bertheloti														1.4	1.2	2.5
Poroeponides lateralis	80.0															
Gyroidina soldanii													0.3	1.4	2.2	4.4
Eponides frigida var. calida		2.2	9.6	10.8	7.7	2.2	6.1	8.0	9.3	9.8	5.7	1.9				
Eponides umbonata											0.2		0.3	0.2	0.4	0.2
Eponides umbonata var. ehrenbergi													0.4	0.4	1.3	2.3
Epistomina elegans													1.0	0.5	0.3	1.7
Cassidulina subglobosa								0.9				0.4	3.0	3.9	5.0	1.1
Cassidulina norcrossi									1.7	2.7	3.9	2.2	1.3	1.4	3.3	0.6
Cassidulina laevigata													0.7	6.7	9.7	3.4
Cassidulina sp.													2.1	0.3	0.3	0.5
Cassidulinoides bradyi														0.4	0.4	1.2
Cibicides pseudoungeriana											0.3	1.1	6.6	14.0	15.3	13.7
Cibicides refulgens		6.3											1.3	2.5	3.5	2.8
Panulina mera														0.3	0.3	0.2
Planulina foveolata													0.5	1.4	0.9	1.5
Miscellaneous	4.5	1.5	7.5	2.1	1.7	1.3	1.8	1.4	3.8	2.3	2.4	2.4	0.8	0.8	1.3	1.7
Estimated number of specimens	350	300	100	1100	650	900	800	1000	2500	2900	14350	16550	64600	120000	119500	74750

TABLE 4. PERCENTAGE DISTRIBUTION OF THE BENTHONIC FORAMINIFERA IN THE MARTHAS VINEYARD TRAVERSE

Sample	1	2	3	4	5	6	7	8	9
Position	40° 10′ N 70° 48′ W	40° 07′ N 70° 48′ W	40° 06′ N 70° 48′ W	40° 03′ N 70° 48′ W	40° 01′ N 70° 48′ W	40° 00′ N 70° 48′ W	39° 59′ N 70° 48′ W	39° 58′ N 70° 48′ W	39° 57′ N 70° 48′ W
Depth (Meters)	122	128	140	228	309	359	393	469	680
Proteonina difflugiformis								5.0	
Textularia goessi(?)				0.1					
Gaudryina (Pseudogaudryina) atlantica	1.5	3.0	2.5	0.3					
Ammosphaeroidina sphaeroidiniformis									0.5
Pseudoclavulina novangliae	3.4	3.4	3.1	0.5					
Listerella nodulosa				0.6	4.5	2.1	12.6	25.3	1.9
Massilina sp.		0.2	0.6						
Robulus sp. 2	0.7	1.1	0.6	0.5					
Robulus sp. 3	2.4	1.7	0.7	0.7					
Lenticulina peregrina					0.2				
Marginulina bacheii	1.4	1.5	0.7						
Dentalina mucronata	0.4	0.2		0.4					
Lagena									0.9
Misc. Lagenidae	0.6	1.7	1.7	1.5	0.8	1.4	2.9		
Nonion cf. barleeanum	0.5	1.0	0.6						
Nonion labradoricum					0.5	1.0	1.8		1.0
Nonion grateloupi var.									0.3
Nonionella turgida		0.2		0.3					
Elphidium incertum	0.5			5.4	33.0	32.8	21.4	14.6	8.6
Bulimina aculeata							1.6	3.5	2.9
Bulimina (Desinobulimina) turgida	0.5	1.6	0.7	0.4		1.2	1.6		0.4
Bulimina (Desinobulimina) auriculata						0.8			
Bulimina marginata	28.5	32.5	9.2	13.1	2.5	2.2			
Bulimina marginata var.						2.2	6.0	17.4	49.7
Bulimina exilis						0.7	3.2	1.4	1.1
Virgulina compressa	0.7	1.2	0.7	0.9					
Virgulina fusiformis				0.3	0.3				1.1
Virgulina sp.					0.6	0.7			

Sample	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Position	40° 10′ N 70° 48′ W	40° 07′ N 70° 48′ W	40° 06′ N 70° 48′ W	40° 03′ N 70° 48′ W	40° 01′ N 70° 48′ W	40° 00′ N 70° 48′ W	39° 59′ N 70° 48′ W	39° 58′ N 70° 48′ W	39° 57′ N 70° 48′ W
Depth (Meters)	122	128	140	228	309	359	393	469	680
Bolivina sp. 1	0.6	2.7	10.1	21.2	19.2	3.9	4.1	1.9	6.1
Bolivina subaenariensis					0.8	0.4			
Uvigerina sp.	0.3	1.4	1.0	0.2					
Uvigerina peregrina									1.6
Uvigerina peregrina var. bradyana	4.1	7.0	0.8	0.3					
Angulogerina angulosa	12.0	10.0	20.1	21.0	6.1	3.7	1.7		
Angulogerina angulosa var.									1.6
Discorbis bertheloti	0.5	1.1		0.5					
Discorbis floridana			1.0						
Gyroidina soldanii	0.5	2.0	1.9	2.9					
Gyroidina orbicularis					1.0	2.1	3.4	1.5	1.4
Eponides frigida var. calida				0.8	2.7	1.0	1.4		
Eponides umbonata	0.2	0.3		0.3	0.5		1.1		
Eponides umbonata var. ehrenbergi	0.5	1.5		0.5					
Eponides sp.			1.9						
Epistomina elegans	0.3	0.5	1.0	0.3					
Valvulineria sp.									1.8
Cassidulina subglobosa	8.9	1.8	2.9	0.9	3.9	8.7	4.3		
Cassidulina norcrossi	1.6	0.7	3.3	3.3	11.2	23.4	13.5	17.7	8.3
Cassidulina laevigata	7.5	1.7	5.0	9.6	4.9	1.2	0.8		1.6
Cassidulinoides bradyi			0.3	0.3	0.8				
Pullenia quinqueloba									0.4
Cibicides pseudoungeriana	15.0	15.2	10.0	8.2	3.4	1.8			
Cibicides refulgens	4.9	1.6	8.8	1.0	1.2	5.1	12.8	2.1	2.4
Planulina foveolata	0.8	1.8	3.1	0.3					
Miscellaneous	1.0	1.9	6.8	3.7	1.7	3.8	6.3	9.5	6.8
Estimated number of specimens	46150	119050	9800	182200	29200	5650	2000	3800	33200

TABLE 5. PERCENTAGE DISTRIBUTION OF THE BENTHONIC FORAMINIFERA IN THE CAPE COD LIGHT TRAVERSE

Sample	2	3	4	5	6	7	8	9	10	11	14
Distance from starting point (miles)	1	2	3	4	5	6	7	8	9	10	13
Depth (meters)	12	32	48	70	85	91	103	121	145	144	203
Proteonina difflugiformis		18.6	24.4	20.0	3.0	4.3	18.0	21.4	26.8	10.6	16.2
Haplophragmoides glomeratum					11.5	26.8	24.0	10.8	6.1	11.4	2.5
Haplophragmoides sp.					0.9		2.2		1.1	1.4	1.0
Haplophragmoides columbiensis						2.2	4.8	2.4			
Haplophragmoides major		4.2	8.7		0.8	1.3	0.9	6.7	1.4	1.3	
Valvulina conica						1.3	10.0	7.0	3.8	1.4	0.5
Eggerella advena	33.4	66.0	27.4	37.6	61.0	32.4	18.7	3.4			
Quinqueloculina seminulum	11.1		3.0								
Trochammina globulosa						1.2	5.7	3.1	1.3		
Trochammina lobata				6.0	1.2						
Trochammina ochracea	5.5										
Trochammina sp.	16.7										
Nonion labradoricum								2.3	5.1	3.9	5.0
Elphidium incertum											4.1
Astrononion stellatum			3.0	1.7	3.1	1.9	1.1	3.7	4.7	8.9	1.5
Elphidium sp.	5.5										
Elphidium subarcticum	5.5	5.1	9.6	6.4	1.7	1.1	2.3	3.7	2.1	1.4	
Robertina arctica								1.4			
Bulimina (Desinobulimina) auriculata									2.5	1.9	12.4
Bulimina aculeata & marginata var.									0.8	2.0	8.8
Virgulina fusiformis				1.6	1.5		1.0		0.9		
Virgulina sp.								1.4	2.5	2.1	0.6
Bolivina subaenariensis									2.3	1.5	29.8
Angulogerina sp. 2				1.0							0.6
Angulogerina angulosa					4.9						
Entosolenia								1.5			
Discorbis sp. 1	11.1										
Discorbis sp. 3	11.1										
Eponides frigida var. calida			1.6	4.0	1.6	1.3			1.5	1.2	3.9
Cassidulina subglobosa		2.6	13.5	6.2	3.0	4.1	3.1	11.6	14.0	16.9	3.5
Cassidulina norcrossi											0.8
Cassidulina laevigata			3.9	11.2	3.8						0.7
Cibicides refulgens						20.5	5.2	11.6	12.1	17.9	3.6
Miscellaneous		3.4	4.8	5.8	2.2	3.1	3.4	8.1	11.0	16.4	4.6
Estimated number of specimens	18	125	450	1400	3000	2200	2200	900	1500	1200	6200

TABLE 6. PERCENTAGE DISTRIBUTION OF THE BENTHONIC FORAMINIFERA IN THE IPSWICH BAY TRAVERSE

Sample	1	5	7	9	10	11
Distance from starting point (miles)	0	2 8/10	4 2/10	5 6/10	6 1/10	6 8/10
Depth (meters)	9	28	37	47	66	71
Proteonina difflugiformis		27.2	16.3	2.1	10.3	9.6
Ammodiscus sp.	0.8					
Haplophragmoides major			1.2	0.9	1.1	1.3
Haplophragmoides glomeratum					2.5	3.3
Haplophragmoides subglobosom						1.5
Spiroplectammina sp.					7.2	6.2
Eggerella advena	81.2	42.4	67.4	78.4	74.0	74.0
Karreriella (?) sp.						2.3
Sigmoilina schlumbergeri	1.6					
Trochammina globulosa	3.2					
Trochammina lobata	13.3	1.0	3.9	2.1	1.6	
Elphidium incertum		1.5	1.7			
Elphidium subarcticum		18.8	1.7	3.5		
Eponides frigida var. calida		4.6	1.1	3.5		
Cassidulina subglobosa		0.8	1.1	1.9		
Cibicides refulgens			2.2	3.8		
Miscellaneous		3.6	3.3	3.8	3.5	1.9
Estimated number of specimens	125	1500	200	450	725	700

TABLE 7. PERCENTAGE DISTRIBUTION OF THE PLANKTONIC FORAMINIFERA IN THE MARYLAND TRAVERSE

Atlantis Station	1238e	1238h	1239a	1239c	1239d	1239e	1239f	1240a
Position			37° 55′ N 74° 20′ W					37° 49′ N 74° 07′ W
Distance from starting point (nautical miles)	29.4	34.5	36.5	40.5	42.5	44.5	46.5	
Depth (meters)	52	63	68	77	99	114	154	386
Sphaeroidina bulloides					0.1	0.2	0.3	0.4
Globigerina bulloides	36.3	32.7	47.8	33.4	34.5	34.4	36.7	14.5
Globigerina eggeri	39.9	25.6	25.8	38.9	39.8	42.5	51.0	63.2
Globigerina inflata	10.4	20.5	14.9	19.6	16.9	18.2	10.3	19.4
Globigerinoides rubra	2.6	9.1	3.2	3.1	3.6	1.3	0.6	
Globigerinoides sacculifera	2.1	0.9	1.9	0.8	1.5	0.6	0.1^-	0.3
Globigerinoides conglobata	6.2	5.6	2.9	3.0	1.9	1.2	0.4	0.7
Orbulina universa		0.9	0.3		0.5	0.2	0.1	
Pulleniatina obliquiloculata	2.1	0.5	0.7		0.3	0.2	0.1	
Globorotalia menardii	0.5	4.1	1.9	0.8	0.8	0.9	0.4	1.3
Globorotalia truncatulinoides						0.1	0.1^-	
Globorotalia tumida								0.1
Miscellaneous			0.6	0.6	0.1			0.1^-
Estimated number of specimens	200	800	18900	2700	46500	75000	636700	88700
Percentage of the planktonic Foraminifera to total fauna	3.1	5.2	8.5	18.7	42.4	56.0	59.9	45.5

TABLE 8. PERCENTAGE DISTRIBUTION OF THE PLANKTONIC FORAMINIFERA IN THE NEW JERSEY TRAVERSE

Alantis Station	1243d	1243b	1242f	1242d	1242c	1242b	1242a	1241c	1241b
Position							38° 47′ N 73° 06′ W		
Distance from starting point (nautical miles)	21.1	26.3	32.3	38.3	41.3	44.3	46.7	49.1	51.5
Depth (meters)	53	66	74	77	82	90	117.7	182	610
Sphaeroidina bulloides							0.7	1.7	0.4
Globigerina bulloides	45.8	58.8	37.7	34.5	27.1	21.1	29.2	42.2	9.7
Globigerina eggeri	22.9	19.7	45.7	46.5	57.7	45.2	47.1	29.1	72.3
Globigerina inflata	20.8	18.8	14.6	15.7	11.1	22.9	18.9	22.2	16.0
Globigerinoides rubra	4.2	1.4	0.8	1.4	1.7	3.1	1.1	1.3	0.1
Globigerinoides sacculifera				0.4		1.0	0.7	0.7	
Globigerinoides conglobata	2.1	0.6		1.2	1.2	4.7	0.8	0.9	0.4
Orbulina universa		0.3				0.3	0.3	0.8	0.1
Pulleniatina obliquiloculata						0.2	0.2	0.1^{-}	0.1
Globorotalia menardii	2.1	0.4			0.4	1.6	0.9	0.8	0.9
Globorotalia truncatulinoides	2.1					0.1^{-}		0.1	0.1^{-}
Globorotalia tumida									0.1^{-}
Miscellaneous			1.2	0.4	0.8				
Estimated number of specimens	50	700	3100	2800	2100	5700	295100	350500	13400
Percentage of the planktonic Foraminifera to total fauna	6.3	10.5	17.6	36.2	40.5	56.6	67.8	76.6	69.8

TABLE 9. PERCENTAGE DISTRIBUTION OF THE PLANKTONIC FORAMINIFERA IN THE BLOCK ISLAND TRAVERSE

Sample	36	39	43	46	49	49a	50	52
Distance from starting point (miles)	47 1/5	50 3/5	55 4/5	59	62	63	65	67
Depth (meters)	80	85	93	97	112	142	167	200
Sphaeroidina bulloides	2.4	3.7	13.9	15.4	10.2	5.2	8.0	7.6
Globigerina bulloides	78.0	18.8	12.8	18.9	14.1	25.8	28.0	27.6
Globigerina eggeri		59.1	53.4	47.7	57.6	51.7	51.5	36.1
Globigerina inflata	7.3	11.0	9.6	9.9	11.0	13.0	8.1	23.0
Globigerinoides rubra	7.3	0.9	2.6	1.7	0.8	1.1	1.6	1.7
Globigerinoides sacculifera		0.9	1.4	1.2	0.9	0.9	0.6	1.0
Globigerinoides conglobata	4.9	1.9	3.1	2.4	2.3	0.8	0.6	1.4
Orbulina universa		0.9	1.0	0.8	0.2	0.3	0.2	0.5
Pulleniatina obliquiloculata		0.9	0.9	0.5	0.3	0.3	0.3	0.2
Globorotalia menardii		0.9	1.1		1.5	0.9	0.8	0.7
Globorotalia hirsuta		0.9						
Globorotalia truncatulinoidos					0.1			0.1
Miscellaneous				1.6			0.1	0.1
Estimated number of specimens	60	110	1000	2400	41900	186100	174100	185600
Percentage of the planktonic Foraminifera to total fauna	2.5	2.5	6.4	13.0	39.3	60.8	59.4	71.3

TABLE 10. PERCENTAGE DISTRIBUTION OF THE PLANKTONIC FORAMINIFERA IN THE MARTHAS VINEYARD TRAVERSE

Sample	1	2	3	4	5	6	7	8	9
Position	40° 10′ N 70° 48′ W	40° 07′ N 70° 48′ W	40° 06′ N 70° 48′ W	40° 03′ N 70° 48′ W	40° 01′ N 70° 48′ W	40° 00′ N 70° 48′ W	39° 59′ N 70° 48′ W	39° 58′ N 70° 48′ W	39° 57′ N 70° 48′ W
Depth (Meters)	122	128	140	228	309	359	393	469	680
Sphaeroidina bulloides	13.9	7.9	1.8	1.7	0.1	0.1	0.2		
Globigerina bulloides	19.1	25.5	24.0	30.4	15.8	12.9	10.8	6.2	7.3
Globigerina eggeri	46.6	48.7	54.0	40.0	53.8	66.5	69.6	60.3	80.0
Globigerina inflata	12.7	12.8	17.2	24.2	28.2	17.9	17.6	29.2	11.4
Globigerinoides rubra	2.9	1.2	0.4	0.9	0.3	0.3	0.1		
Globigerinoides sacculifera	1.4	1.8	0.2	0.7	0.2	0.2	0.1		
Globigerinoides conglobata	1.0	0.7	0.5	0.6	0.3	0.8	0.4	1.1	
Orbulina universa	0.2	0.3	0.1	0.2	0.1	0.2	0.1		0.1
Pulleniatina obliquiloculata	0.3	0.7	0.2	0.5	0.2	0.1	0.2		
Globorotalia menardii	1.8	0.4	0.9	0.6	1.0	0.8	0.8	1.8	0.5
Globorotalia hirsuta	0.1		0.1		0.1				
Globorotalia truncatulinoides			0.1	0.1		0.2	0.2	0.6	0.1
Globorotalia tumida			0.5		0.1	0.1	0.1	0.6	0.1
Miscellaneous		0.1							0.3
Estimated number of specimens	35000	188700	38200	282500	82000	18300	13500	6500	83300
Percentage of the planktonic Foraminifera to total fauna	43.1	61.3	74.3	60.8	73.8	76.3	87.1	63.1	71.5

PLATES

PLATE 1

PLATE 1

Species Typical of Zone 2

Fig. 1. *Haplophragmoides major* Cushman. (X36.) Cape Cod Light traverse, 121 m.

Fig. 2. *Eggerella advena* Cushman. (X54.) Cape Cod Light traverse, 103 m.

Figs. 3 a, b. *Quinqueloculina seminulum* (Linnaeus). (X40.) (a, b) opposite sides. Block Id. traverse, 67 m.

Figs. 4 a, b. *Triloculina* sp. (X44.) (a, b) opposite sides. Maryland traverse, 68 m.

Fig. 5. *Quinqueloculina seminulum* (Linnaeus) var. *jugosa* Cushman. (X50.) Maryland traverse, 24.5 m.

Fig. 6. *Ammodiscus* sp. (X40.) Ipswich Bay traverse, 9 m.

Figs. 7 a, b. *Trochammina lobata* Cushman. (X54.) (a) dorsal view; (b) ventral view. New Jersey traverse, 46 m.

Fig. 8. *Globulina inaequalis* Reuss. (X48.) Maryland traverse, 63 m.

Fig. 9. *Pyrgo striatella* (Cushman). (X45.) Maryland traverse, 68 m.

Fig. 10. *Globulina inaequalis* Reuss var. *caribaea* d'Orbigny. (X46.) Maryland traverse, 63 m.

Fig. 11. *Nonion sloanii* (d'Orbigny). (X50.) Maryland traverse, 52 m.

Fig. 12. *Elphidium* sp. (X.46) Maryland traverse, 24.5 m.

Fig. 13. *Bolivina pseudoplicata* Heron-Allen and Earland. (X50.) Maryland traverse, 68 m.

Fig. 14. *Angulogerina* sp. 1. (X54.) New Jersey traverse, 46 m.

Fig. 15. *Discorbis* sp. 2. (X80.) Maryland traverse, 24.5 m.

Figs. 16 a, b. *Cibicides concentrica* (Cushman). (X40.) (a) ventral view; (b) dorsal view. Maryland traverse, 52 m.

Figs. 17 a, b. *Poroeponides lateralis* (Terquem). (X45.) (a) dorsal view; (b) ventral view. Block Id. traverse, 19 m.

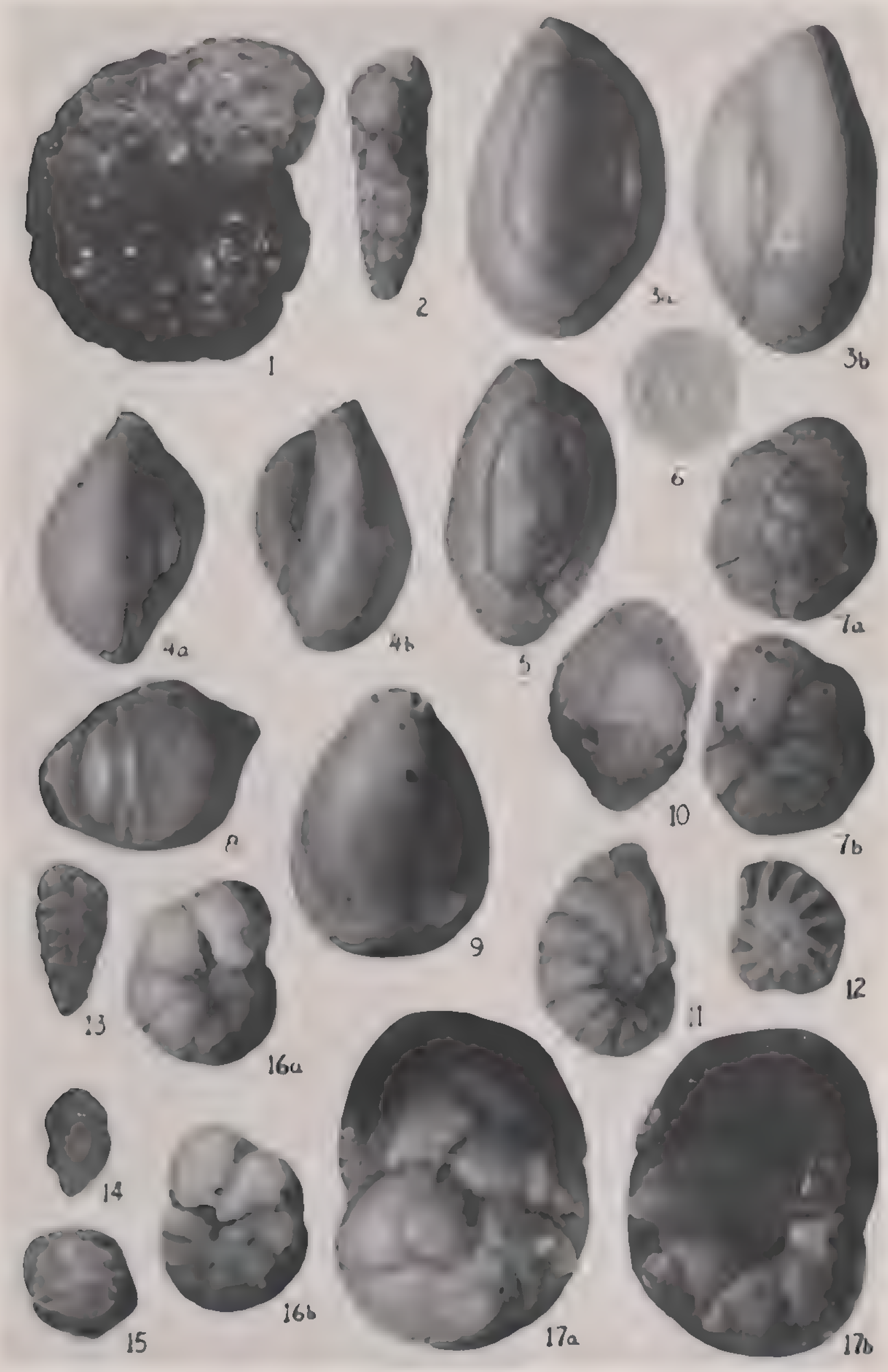
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PLATE 2

PLATE 2

Species Typical of Zone 3

Fig. 1. *Textularia goessi* Cushman (?). (X44.) Block Id. traverse, 112 m.

Fig. 2. *Textularia pseudotrochus* Cushman. (X30.) Block Id. traverse, 121 m.

Fig. 3. *Gaudryina* (*Pseudogaudryina*) *atlantica* (Bailey). (X24.) Block Id. traverse, 112 m.

Fig. 4. *Trochammina globigeriniformis* (Parker and Jones). (X50.) Maryland traverse, 114 m.

Fig. 5. *Textularia candeiana* d'Orbigny. (X48.) New Jersey traverse, 182 m.

Fig. 6. *Plectina apicularis* (Cushman). (X46.) Block Id. traverse, 97 m.

Fig. 7. *Karreriella affinis* (Fornasini). (X50.) Maryland traverse, 154 m.

Fig. 8. *Massilina* sp. (X50.) Block Id. traverse, 142 m.
120 m.

Fig. 9. *Pyrgo* cf. *denticulata* (H. B. Brady). (X 44.) Block Id. traverse, 120 m.

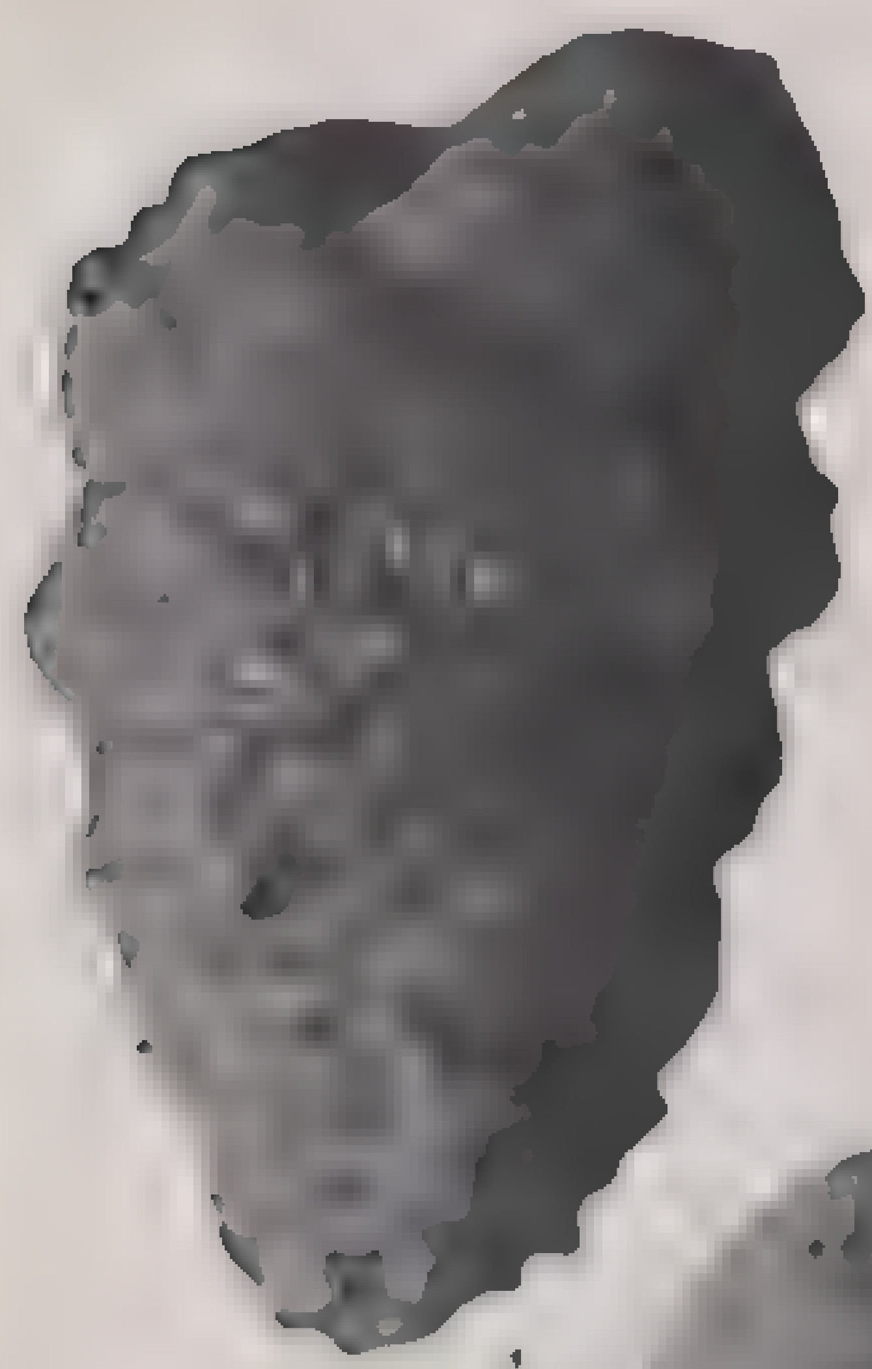
Fig. 10. *Pyrgo subsphaerica* (d'Orbigny). (X30.) Block Id. traverse, 121 m.

Fig. 11. *Robulus* sp. 3. (X34.) Maryland traverse, 154 m.

Fig. 12. *Robulus* sp. 1. (X44.) Block Id. traverse, 167 m.

Fig. 13. *Robulus* sp. 2. (X45.) Block Id. traverse, 97 m.

Fig. 14. *Pseudoclavulina novangliae* (Cushman). (X40.) Block Id. traverse, 167 m.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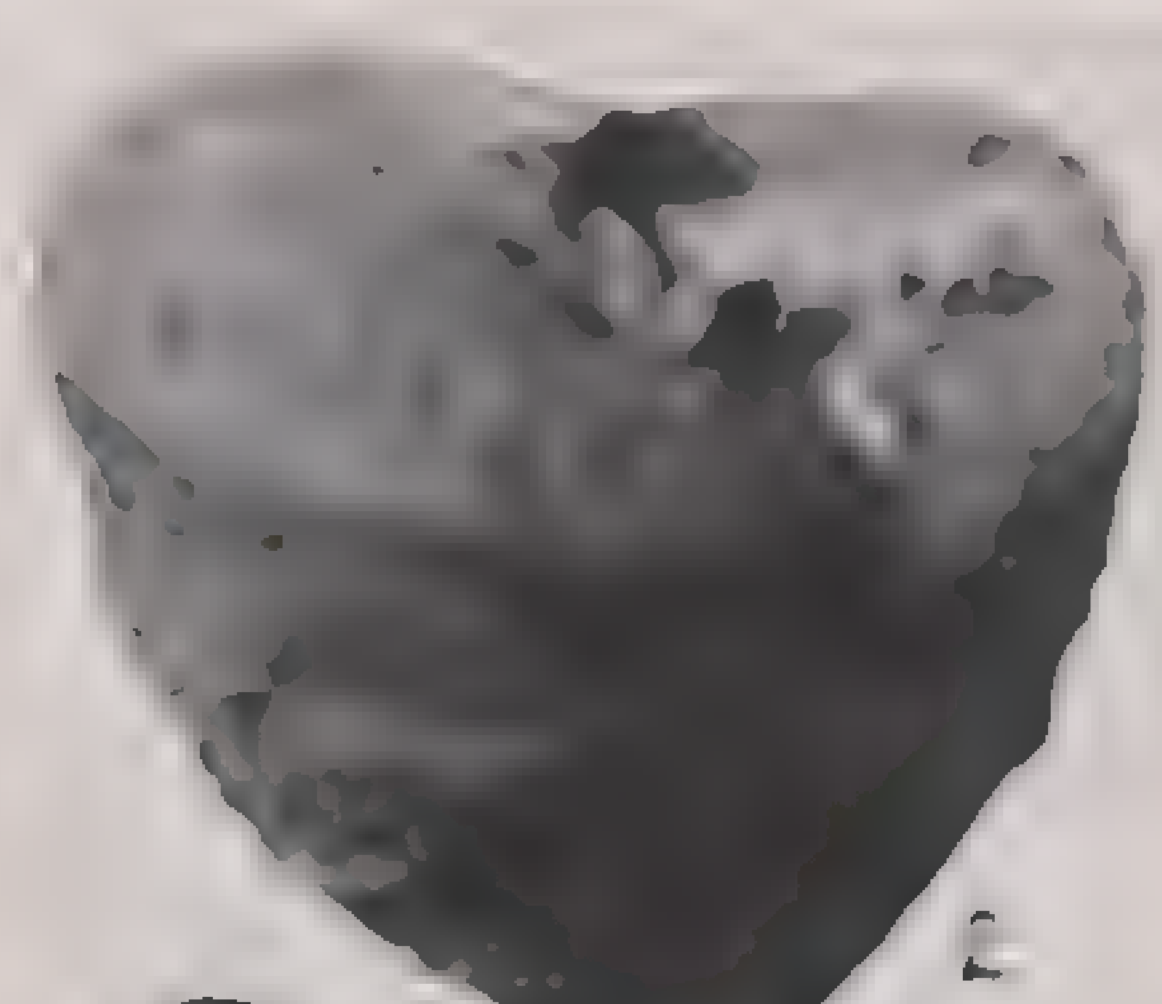
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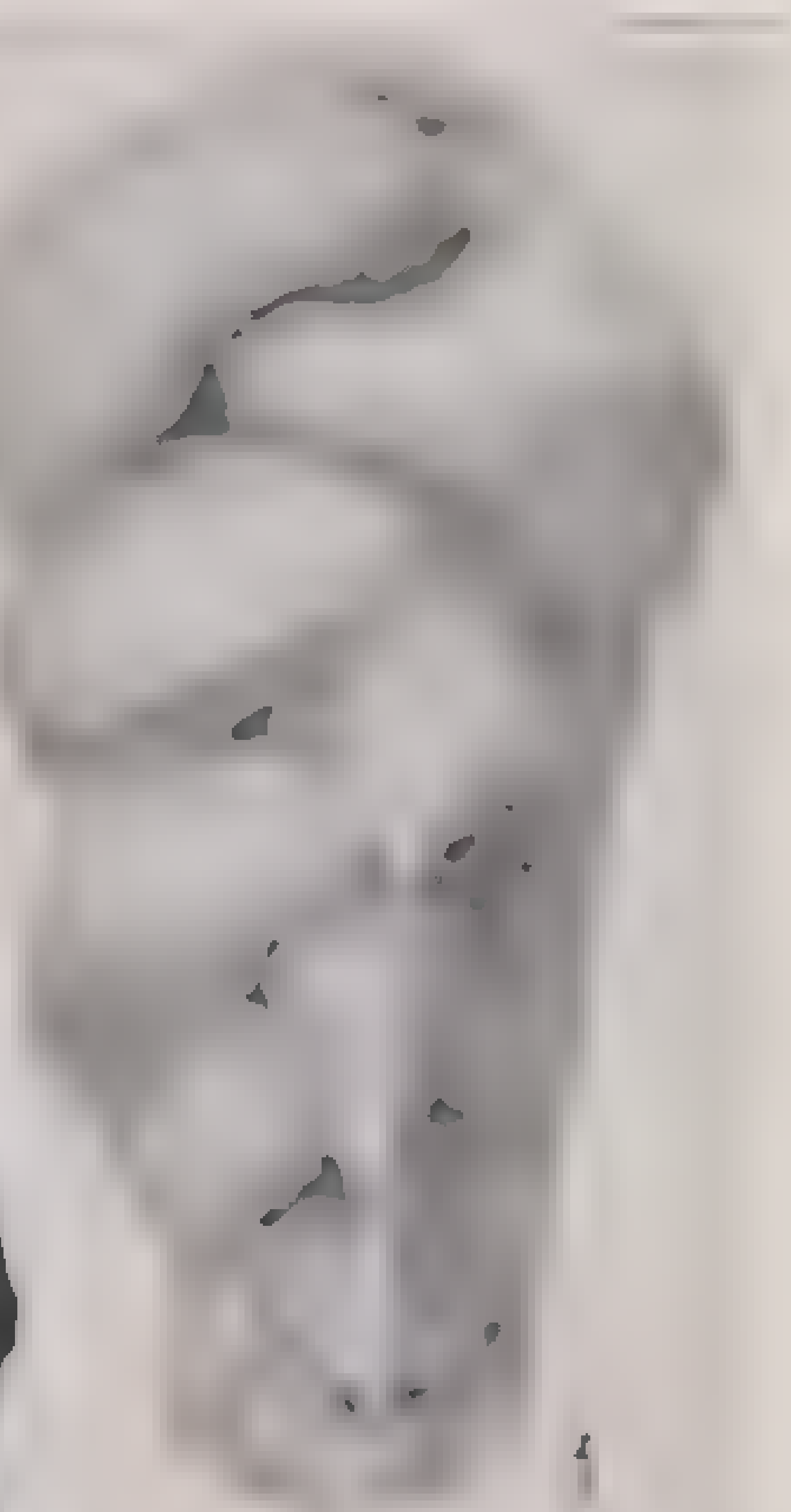
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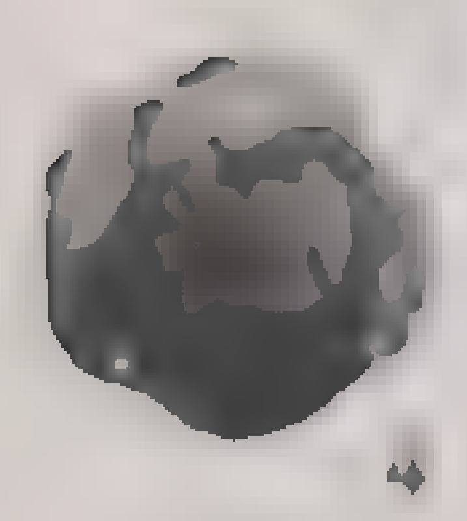
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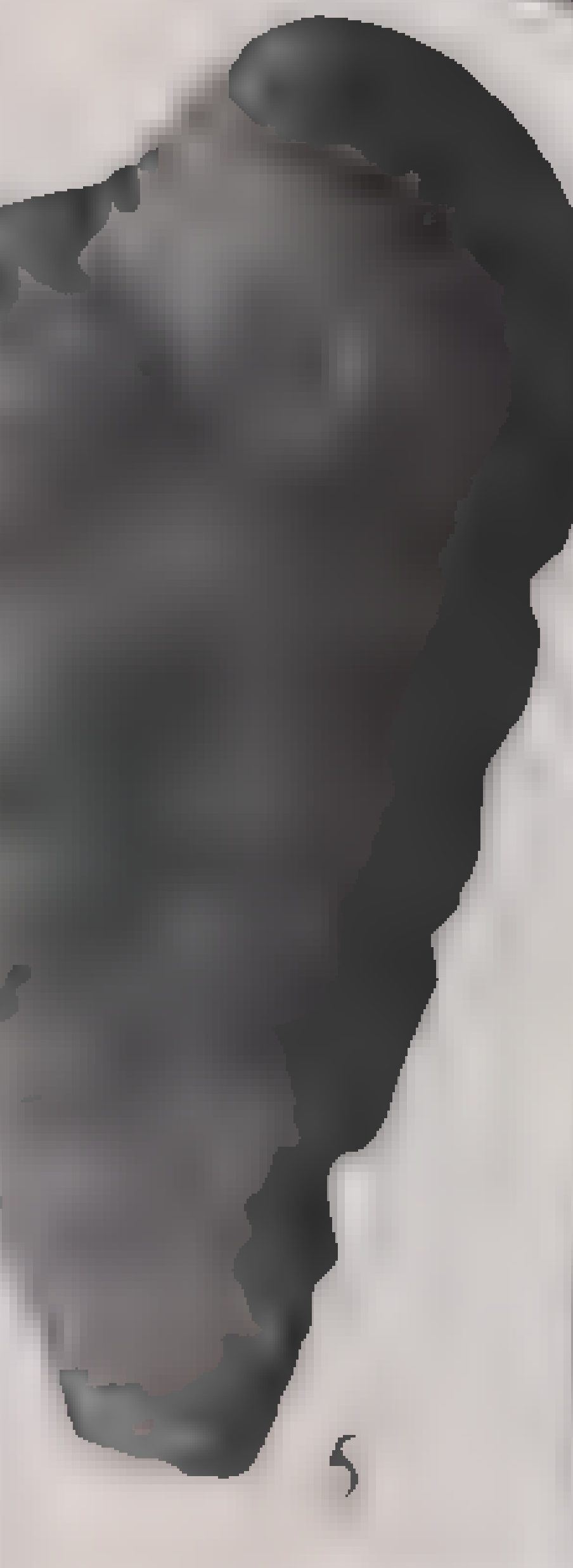
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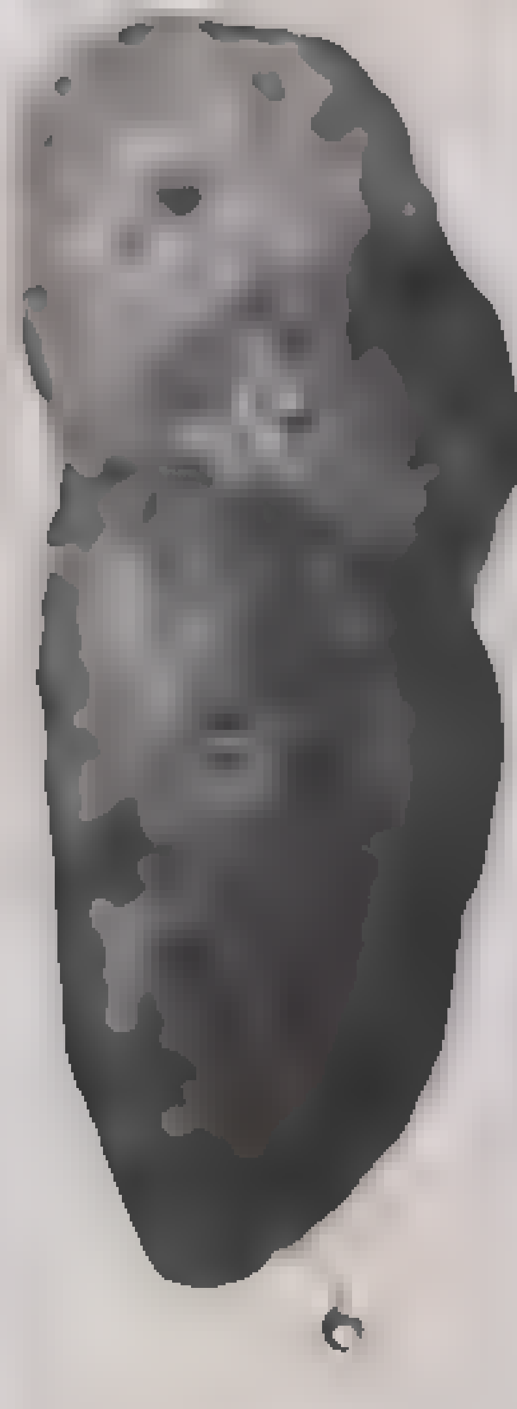
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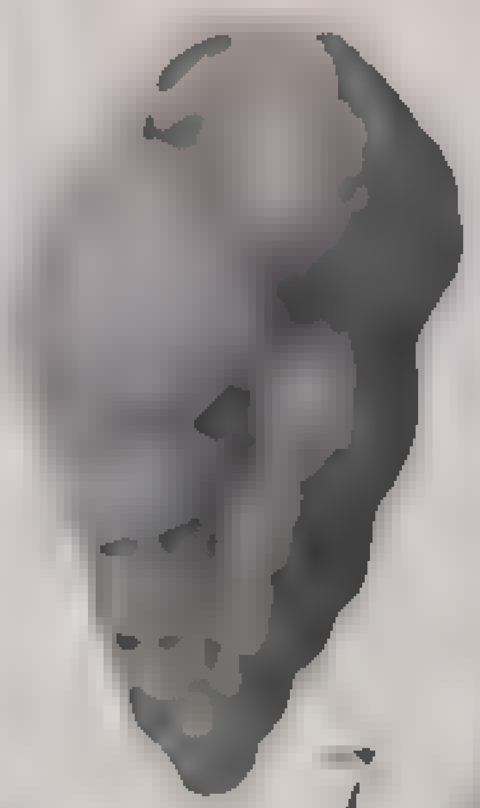
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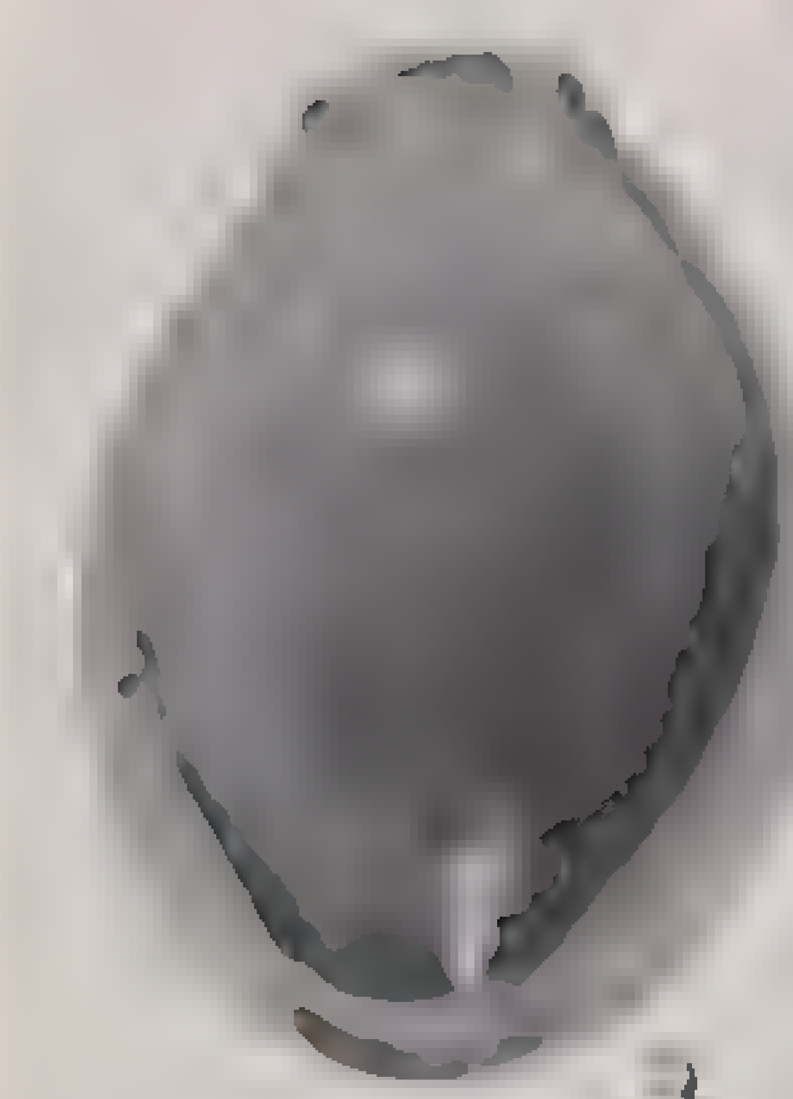
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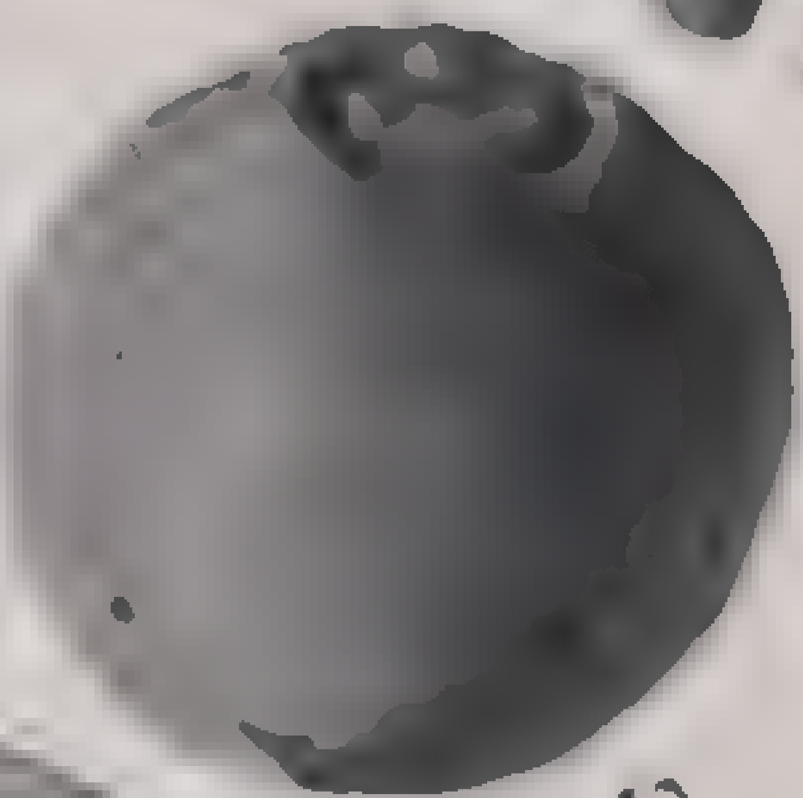
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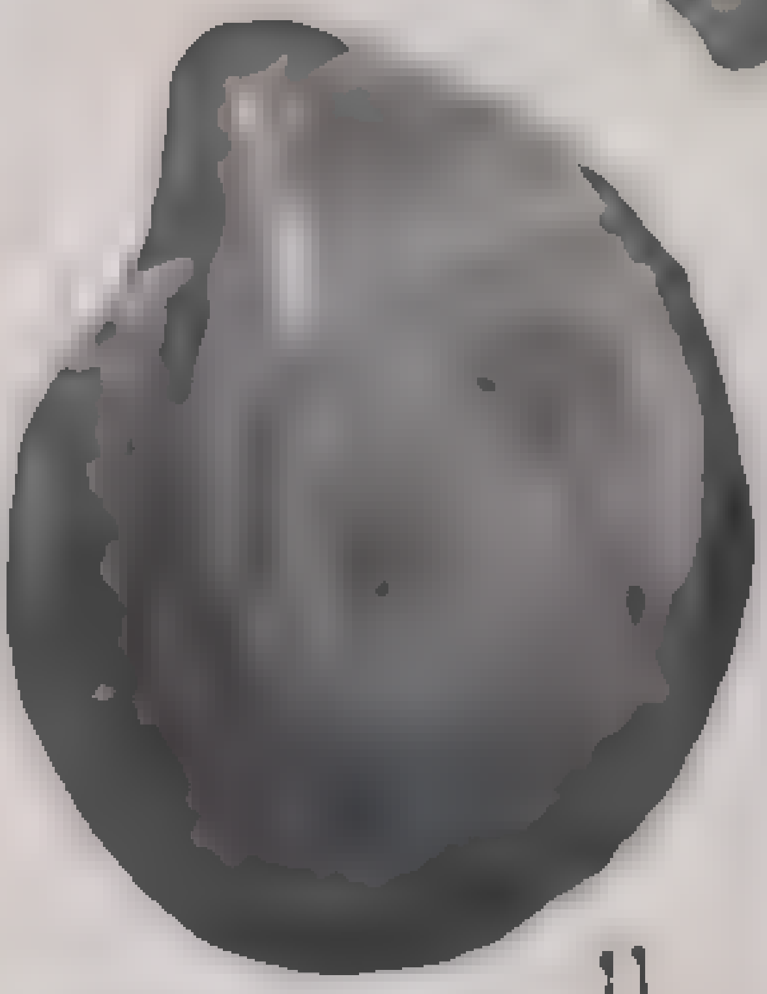
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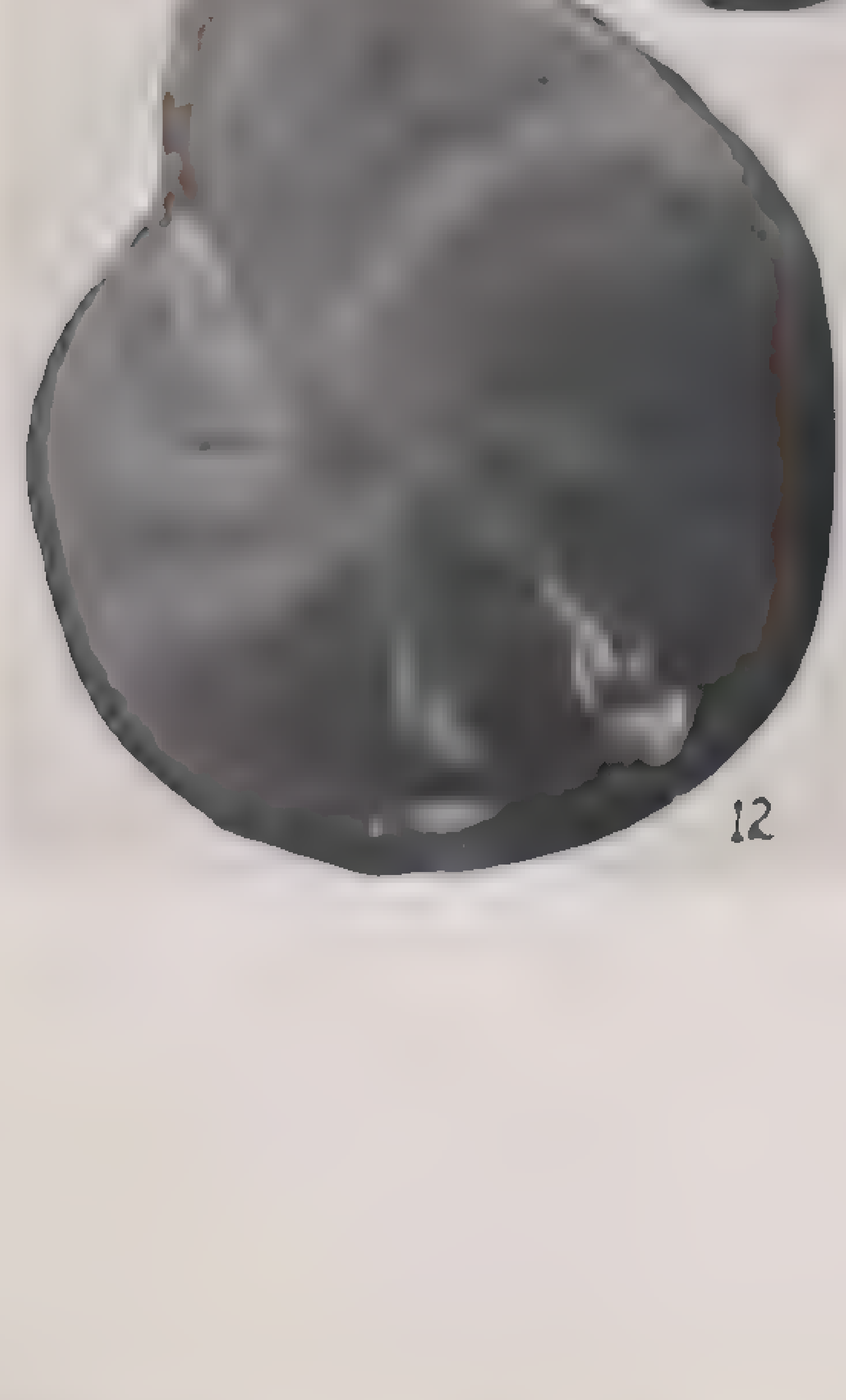
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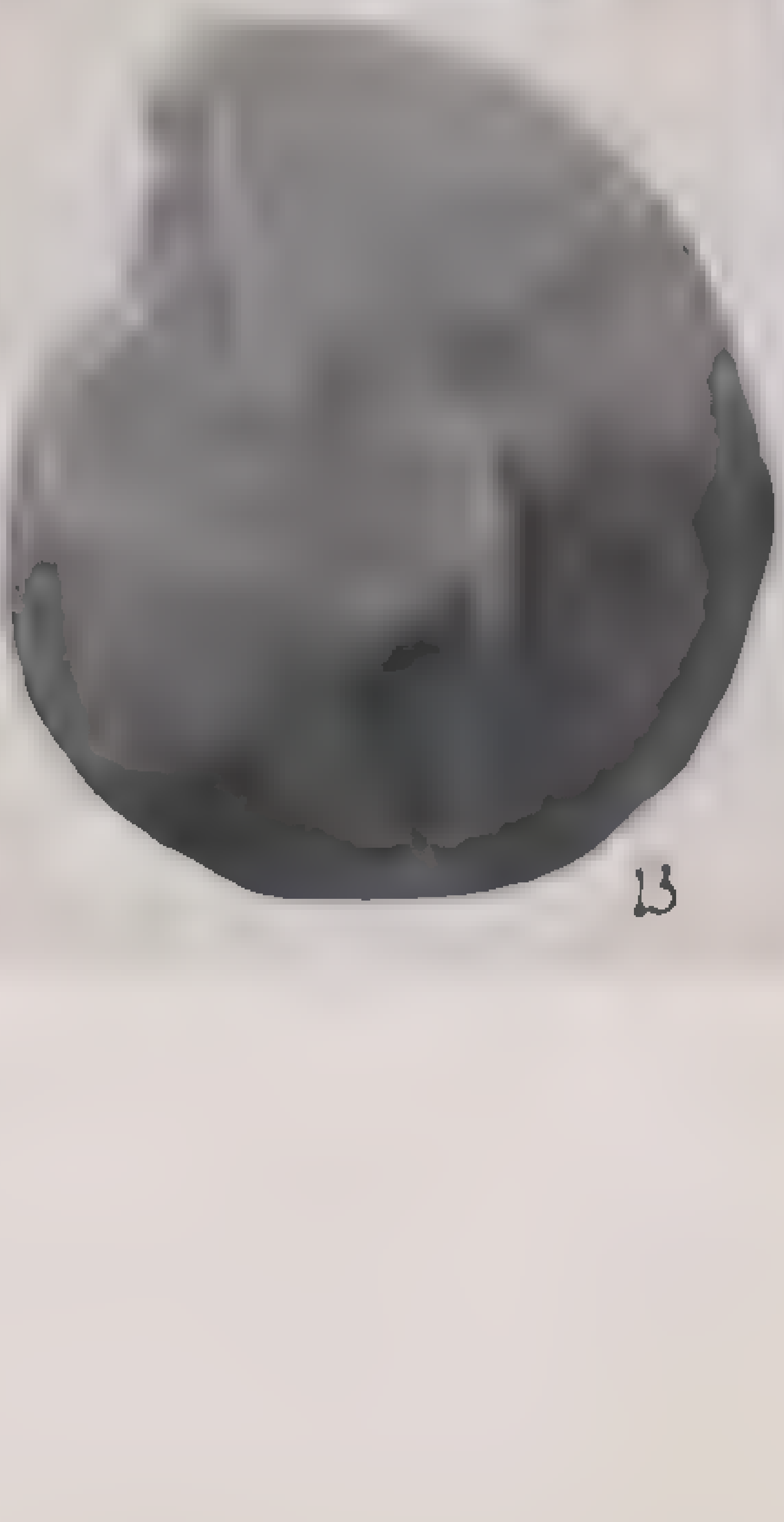
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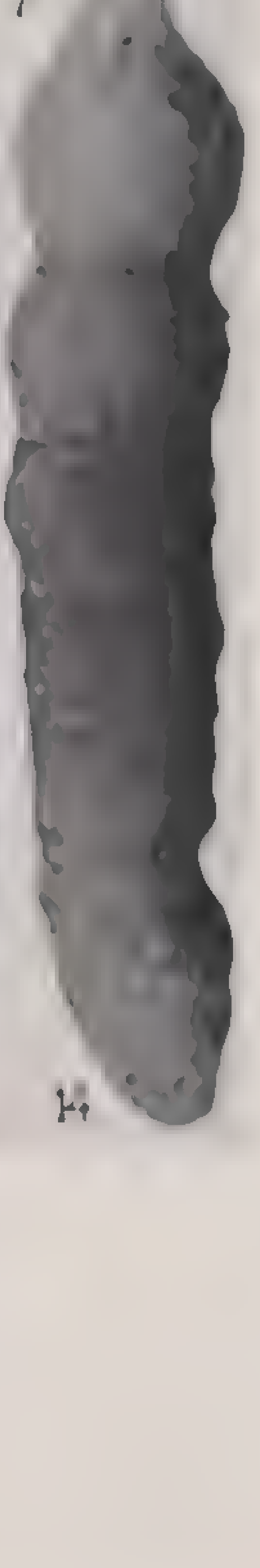
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PLATE 3

PLATE 3

Species Typical of Zone 3 (continued)

Fig. 1. *Marginulina bacheii* Bailey. (X40.) Block Id. traverse, 97 m.

Fig. 2. *Pseudopolymorphina atlantica* Cushman and Ozawa. (X54.) Maryland traverse, 114 m.

Fig. 3. *Nonion* cf. *barleeanum* (Williamson). (X50.) Block Id. traverse, 142 m.

Fig. 4. *Nonion grateloupi* (d'Orbigny). (X54.) Block Id. traverse, 142 m.

Figs. 5 a, b. *Discorbis bertheloti* (d'Orbigny). (X46.) (a) dorsal view; (b) ventral view. Block Id. traverse, 142 m.

Figs. 6 a, b. *Nonionella turgida* (Williamson). (X58.) (a, b) opposite sides. Block Id. traverse, 142 m.

Fig. 7. *Robertina* sp. (X48.) Marthas Vineyard traverse, 128 m.

Figs. 8 a, b. *Gyroidina soldanii* d'Orbigny. (X40.) (a) dorsal view; (b) ventral view. Block Id. traverse, 167 m.

Fig. 9. *Epistomina elegans* (d'Orbigny). (X46.) Block Id. traverse, 167 m.

Fig. 10. *Virgulina compressa* (Bailey). (X44.) Marthas Vineyard traverse, 128 m.

Figs. 11 a, b. *Cancris sagra* (d'Orbigny). (X48.) (a) dorsal view; (b) ventral view. Maryland traverse, 99 m.

Fig. 12. *Cassidulinoides bradyi* (Norman). (X42.) Block Id. traverse, 167 m.

Figs. 13 a, b. *Eponides* sp. (X40.) (a) dorsal view; (b) ventral view. Marthas Vineyard traverse, 140 m.

Fig. 14. *Pulvinulinella* cf. *exigua* (H. B. Brady). (X48.) Maryland tra verse, 99 m.

Fig. 15. *Chilostomella ovoidea* Reuss. (X50.) Block Id. traverse, 200 m.

Figs. 16 a, b. *Eponides umbonata* (Reuss) var. *ehrenbergi* (Bailey). (X30.) (a) dorsal view; (b) ventral view. Block Id. traverse, 167 m.

Figs. 17 a, b. *Planulina foveolata* (H. B. Brady). (X45.) (a) ventral view; (b) dorsal view. Block Id. traverse, 167 m.

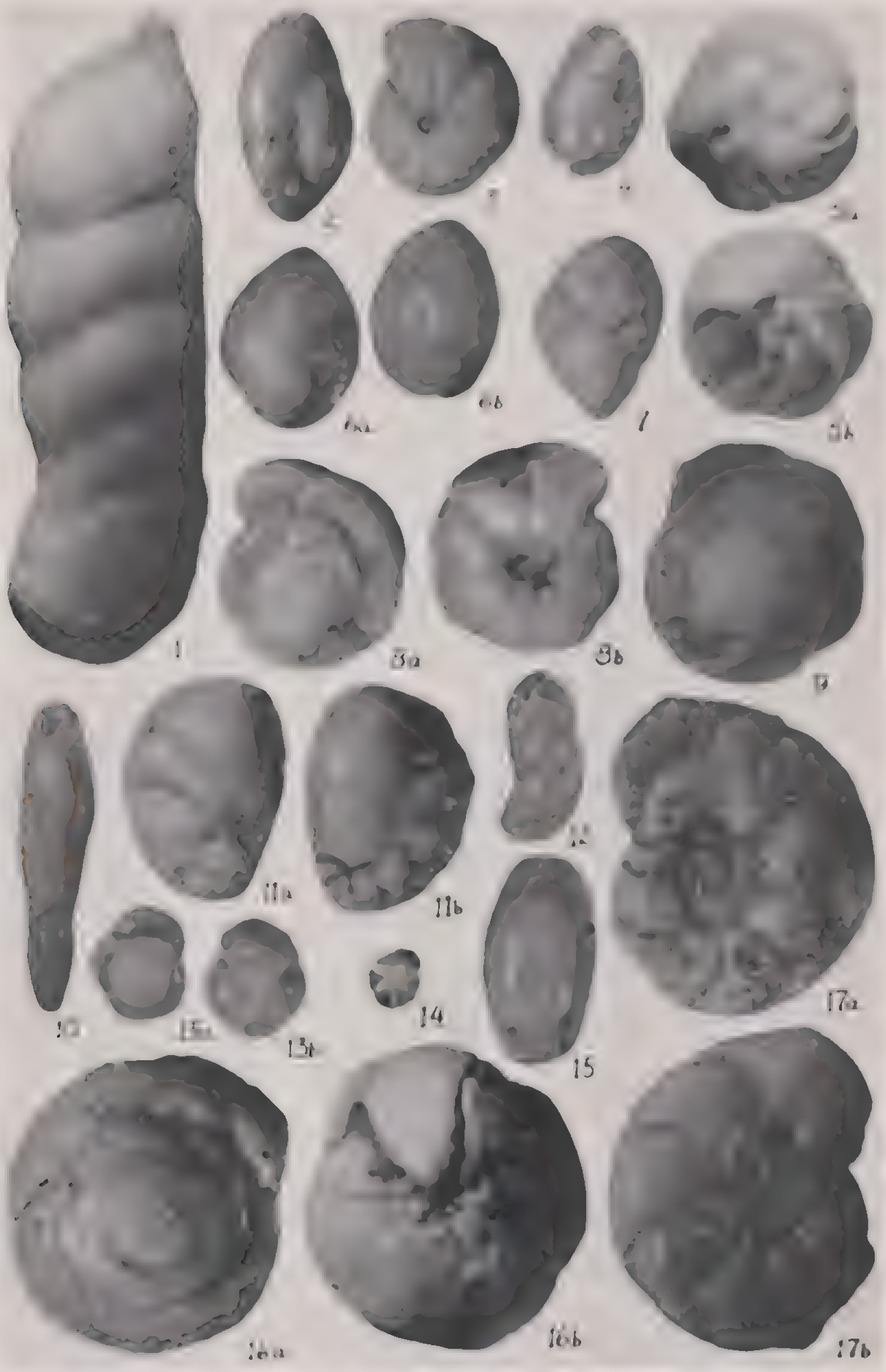
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PLATE 4

PLATE 4

Figures 1–14, Species Typical of Zone 4

Figs. 1, 2. *Valvulina conica* Parker and Jones. (1) (X44.); (2) (X46.). (1) bottom view; (2) apertural view of another specimen. Cape Cod Light traverse, 103 m.

Fig. 3. *Ammosphaeroidina sphaeroidiniformis* (H. B. Brady). (X22.) Marthas Vineyard traverse, 680 m.

Fig. 4. *Listerella nodulosa* (Cushman). (X40.) Marthas Vineyard traverse, 228 m.

Fig. 5. *Karreriella bradyi* (Cushman). (X40.) Marthas Vineyard traverse, 680 m.

Fig. 6. *Pseudoglandulina occidentalis* (Cushman). (X42.) New Jersey traverse, 610 m.

Fig. 7. *Nonion grateloupi* (d'Orbigny) var. (X46.) Marthas Vineyard traverse, 680 m.

Fig. 8. *Bolivina subspinescens* Cushman. (X60.) Marthas Vineyard traverse, 680 m.

Fig. 9. *Bulimina exilis* (H. B. Brady). (X54.) Marthas Vineyard traverse, 680 m.

Fig. 10. *Bulimina marginata* d'Orbigny var. (X40.) Marthas Vineyard traverse, 680 m.

Fig. 11. *Uvigerina peregrina* Cushman. (X34.) Marthas Vineyard traverse, 680 m.

Fig. 12. *Angulogerina angulosa* (Williamson) var. (X52.) Marthas Vineyard traverse, 680 m.

Figs. 13 a, b. *Valvulineria* sp. (X58.) (a) dorsal view; (b) ventral view. Marthas Vineyard traverse, 680 m.

Figs. 14 a, b. *Gyroidina orbicularis* d'Orbigny. (X44.) (a) dorsal view; (b) ventral view. Marthas Vineyard traverse, 680 m.

Fig. 15. *Proteonina difflugiformis* (H. B. Brady). (X46.) Block Id. traverse, 80 m.

Fig. 16. *Haplophragmoides glomeratum* (H. B. Brady). (X48.) Cape Cod Light traverse, 91 m.

Fig. 17. *Haplophragmoides columbiensis* Cushman. (X40.) Cape Cod Light traverse, 103 m.

Fig. 18. *Haplophragmoides subglobosum* (G. O. Sars). (X40.) Ipswich Bay traverse, 71 m.

Fig. 19. *Lagena hexagona* (Williamson). (X48.) Maryland traverse, 154 m.

Fig. 20. *Haplophragmoides* sp. (X40.) Cape Cod Light traverse, 103 m.

Fig. 21. *Spiroplectammina* sp. (X46.) Ipswich Bay traverse, 71 m.

Figs. 22 a, b. *Trochammina globulosa* Cushman. (X46.) (a) dorsal view; (b) ventral view. Cape Cod Light traverse, 103 m.

Fig. 23. *Lagena torquata* H. B. Brady. (X44.) Maryland traverse, 154 m.

Fig. 24. *Lagena laevis* (Montagu) var. nebulosa Cushman. (X48.) Maryland traverse, 154 m.

Fig. 25. *Lenticulina peregrina* (Schwager). (X54.) Marthas Vineyard traverse, 228 m.

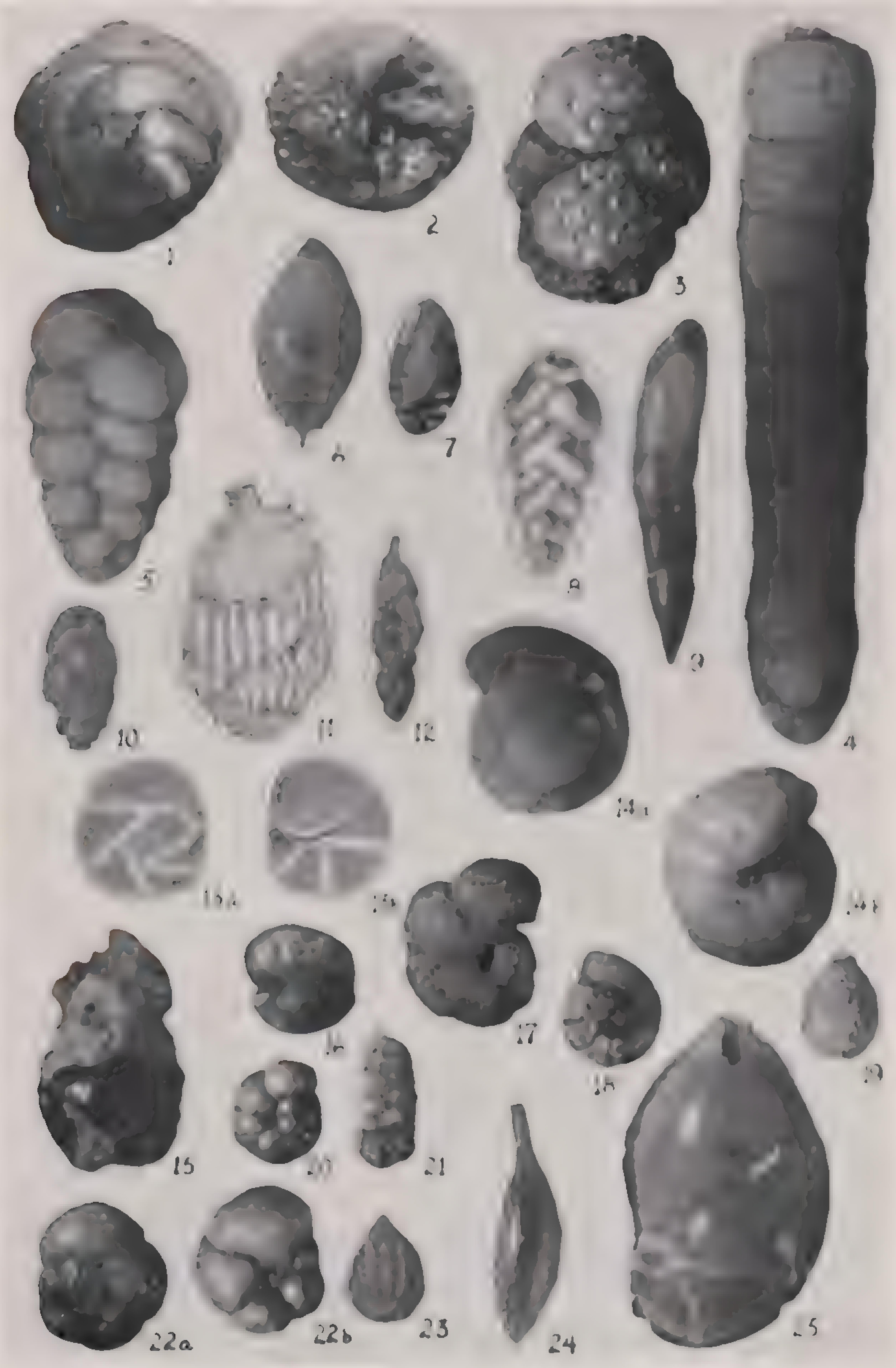
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PLATE 5

PLATE 5

Species Not Confined to One Zone

Fig. 1. *Dentalina mucronata* (Neugeboren). (X42.) Block Id. traverse, 167 m.

Fig. 2. *Nodosaria pyrula* d'Orbigny. (X50.) Block Id. traverse, 167 m.

Fig. 3. *Guttulina lactea* (Walker and Jacob). (X30.) Maryland traverse, 63 m.

Fig. 4. *Elphidium subarcticum* Cushman. (X42.) Maryland traverse, 49 m.

Fig. 5. *Nonion labradoricum* (Dawson). (X52.) Block Id. traverse, 142 m.

Fig. 6. *Astrononion stellatum* Cushman and Edwards. (X44.) Cape Cod Light traverse, 144 m.

Fig. 7. *Elphidium incertum* (Williamson). (X40.) Maryland traverse, 49 m.

Fig. 8. *Robertina arctica* d'Orbigny. (X42.) Cape Cod Light traverse, 121 m.

Fig. 9. *Bulimina* (*Desinobulimina*) *auriculata* Bailey. (X38.) Cape Cod Light traverse, 203 m.

Fig. 10. *Bulimina* (*Desinobulimina*) *turgida* Bailey. (X30.) Marthas Vineyard traverse, 680 m.

Fig. 11. *Bulimina marginata* d'Orbigny. (X42.) Block Id. traverse, 142 m.

Fig. 12. *Bulimina aculeata* d'Orbigny. (X45.) Marthas Vineyard traverse, 680 m.

Fig. 13. *Bulimina* sp. (X50.) Maryland traverse, 99 m.

Fig. 14. *Virgulina* sp. (X50.) Marthas Vineyard traverse, 359 m.

Fig. 15. *Virgulina fusiformis* Williamson. (X48.) Marthas Vineyard traverse, 228 m.

Fig. 16. *Bolivina* sp. 1. (X50.) Marthas Vineyard traverse, 128 m.

Fig. 17. *Bolivina subaenariensis* Cushman. (X50.) Maryland traverse, 154 m.

Fig. 18. *Bolivina* sp. 2. (X48.) Maryland traverse, 154 m.

Fig. 19. *Uvigerina* sp. (X50.) Block Id. traverse, 112 m.

Fig. 20. *Uvigerina peregrina* Cushman var. *bradyana* Cushman. (X54.) Block Id. traverse, 112 m.

Fig. 21. *Angulogerina angulosa* (Williamson). (X50.) Block Id. traverse, 112 m.

Fig. 22. *Angulogerina* sp. 2. (X50.) Cape Cod Light traverse, 203 m.

Figs. 23 a, b. *Discorbis floridana* Cushman. (X54.) (a) dorsal view; (b) ventral view. Maryland traverse, 99 m.

Figs. 24 a, b. *Discorbis obtusa* d'Orbigny. (X44.) (a) dorsal view; (b) ventral view. Maryland traverse, 99 m.

Figs. 25 a, b. *Eponides frigida* (Cushman) var. *calida* Cushman and Cole. (X46.) (a) dorsal view; (b) ventral view. Block Id. traverse, 97 m.

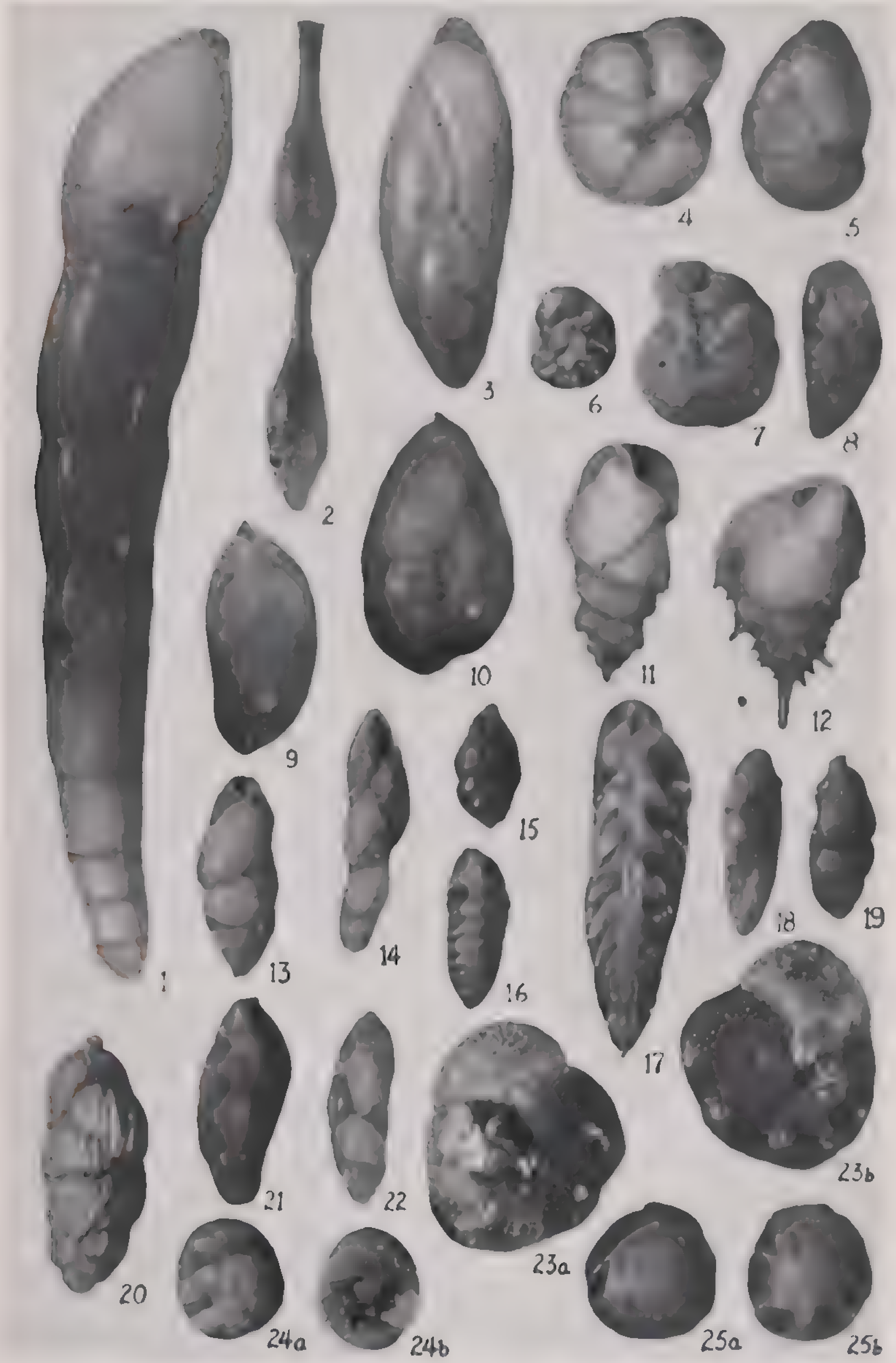
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PLATE 6

PLATE 6

Species Not Confined to One Zone

Figs. 1 a, b. *Eponides umbonata* (Reuss). (X52.) (a) dorsal view; (b) ventral view. Block Id. traverse, 167 m.

Figs. 2 a, b. *Cassidulina norcrossi* Cushman. (X46.) (a, b) opposite sides. Maryland traverse, 154 m.

Figs. 3 a, b. *Cassidulina subglobosa* H. B. Brady. (X46.) (a, b) opposite sides. Maryland traverse, 154 m.

Fig. 4. *Cassidulina laevigata* d'Orbigny. (X50.) Maryland traverse, 154 m.

Figs. 5 a, b. *Cassidulina crassa* d'Orbigny. (X50.) (a, b) opposite sides. Maryland traverse, 154 m.

Figs. 6 a, b. *Cassidulina* sp. (X42.) (a, b) opposite sides. Maryland traverse, 99 m.

Figs. 7 a, b. *Cibicides pseudoungeriana* (Cushman). (X46.) (a) dorsal view; (b) ventral view. Block Id. traverse, 167 m.

Fig. 8. *Pullenia quinqueloba* (Reuss). (X48.) Maryland traverse, 154 m.

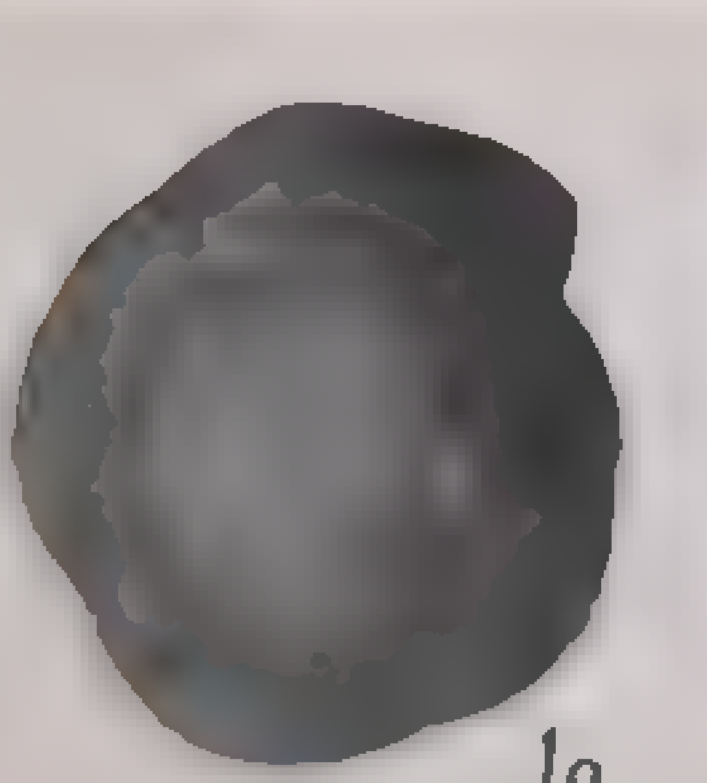
Figs. 9 a, b. *Planulina mera* Cushman. (X40.) (a) ventral view; (b) dorsal view. Maryland traverse, 52 m.

Figs. 10 a, b. *Cibicides refulgens* (Montfort). (X42.) (a) ventral view; (b) dorsal view. Maryland traverse, 52 m.

Fig. 11.[1] *Orbulina universa* d'Orbigny. (X46.) Marthas Vineyard traverse, 309 m.

Figs. 12, 13. *Globigerina inflata* d'Orbigny. (X46.) (12) dorsal view; (13) ventral view of another specimen. Marthas Vineyard traverse, 309 m.

[1] Figures 11–13 are planktonic forms.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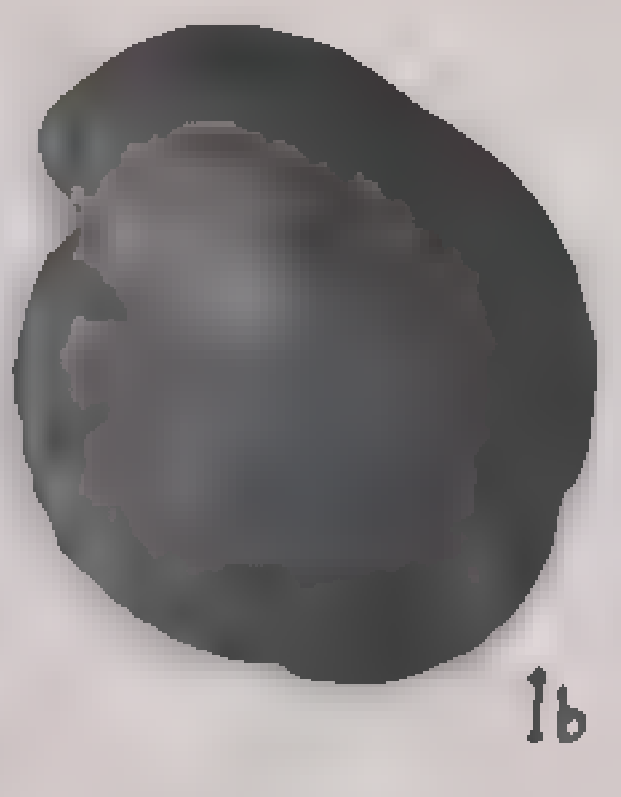
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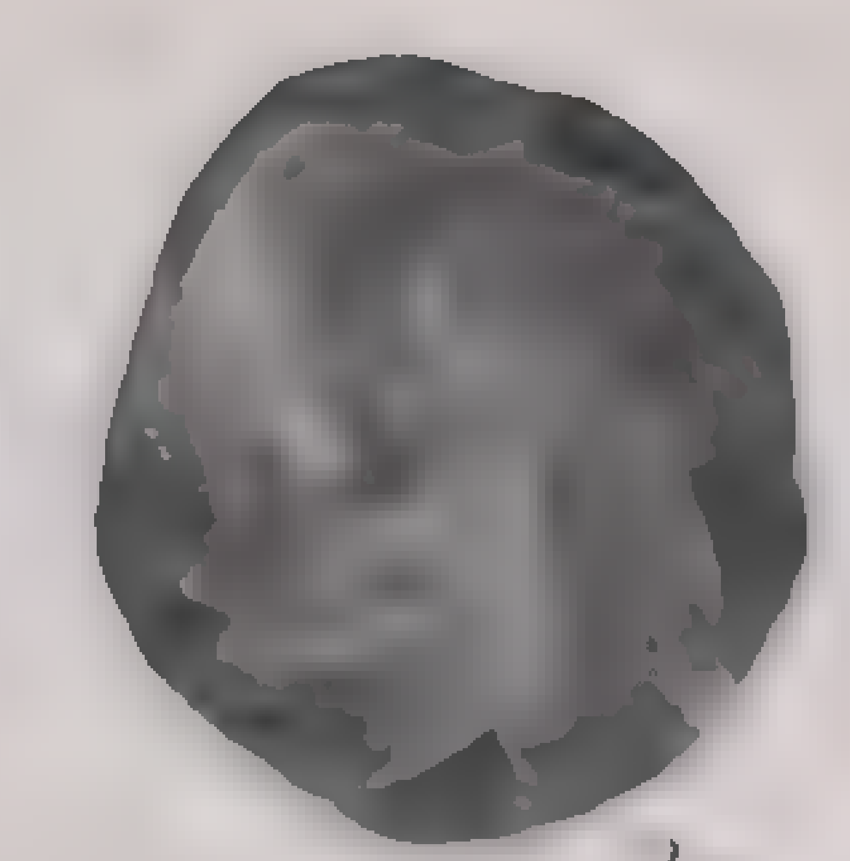
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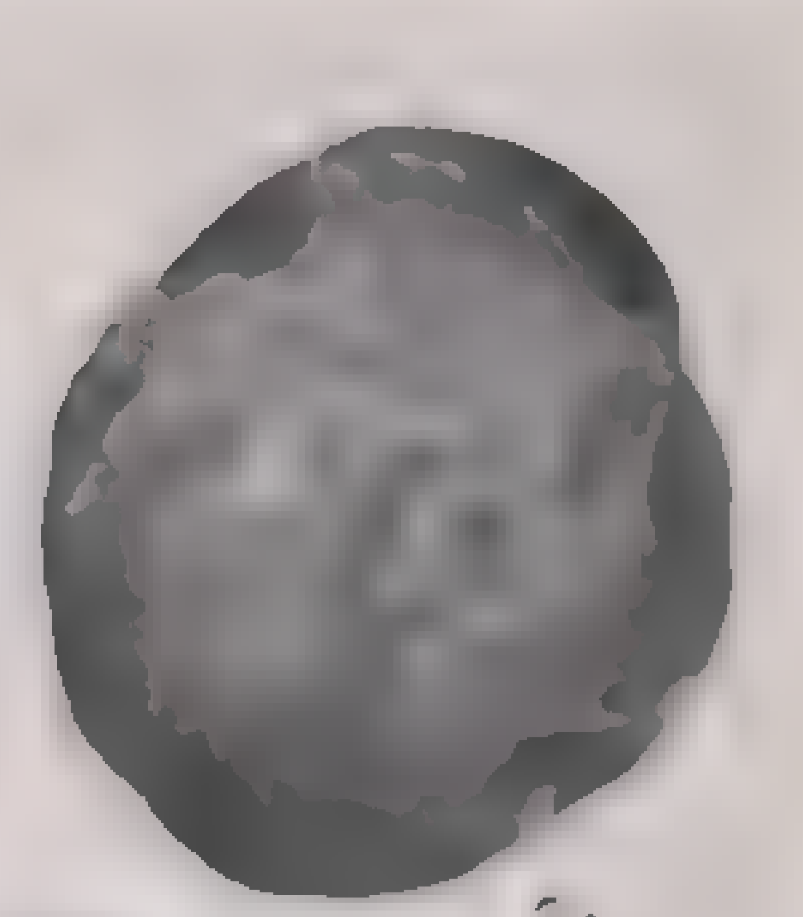
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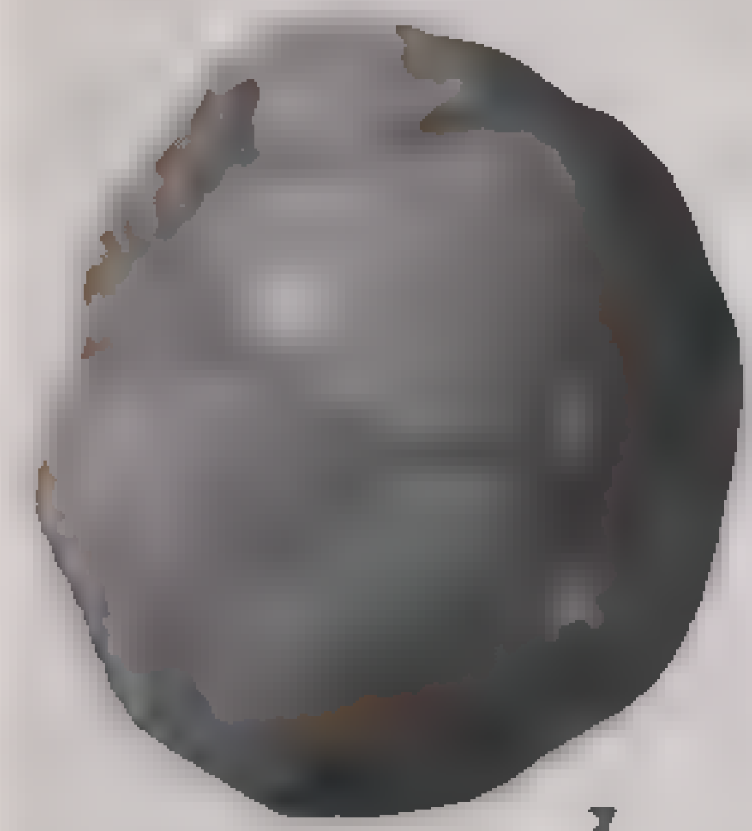
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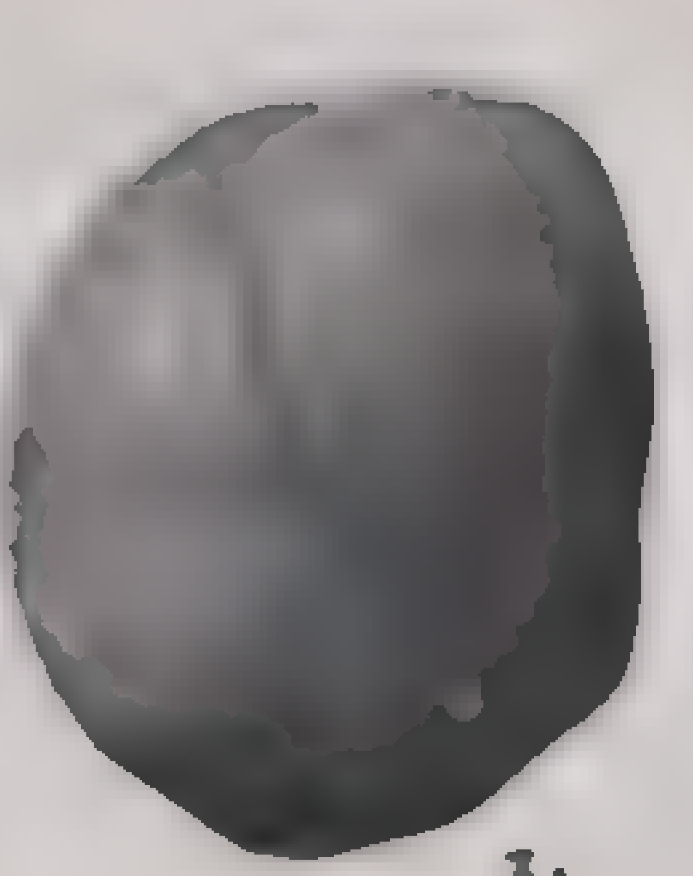
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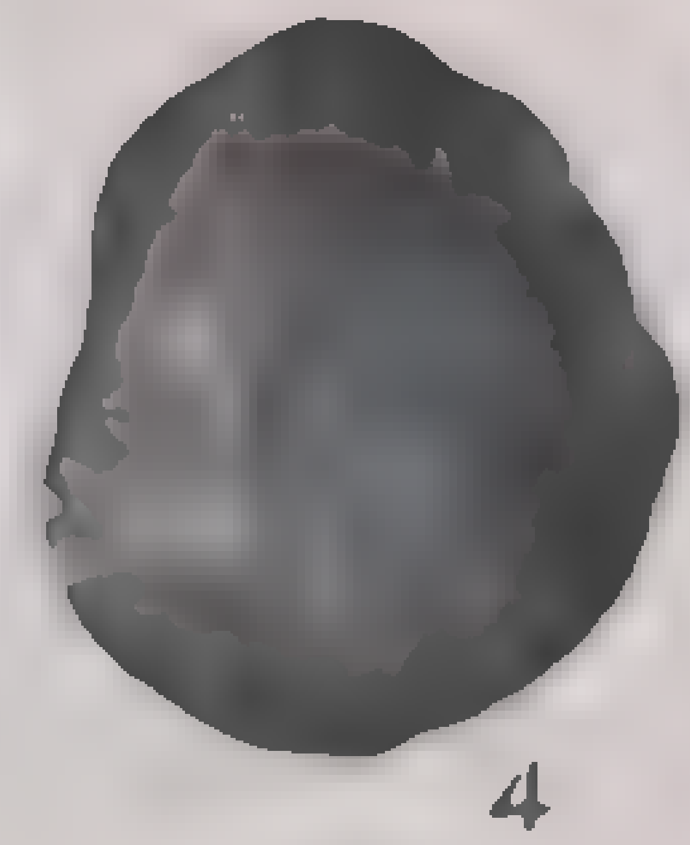
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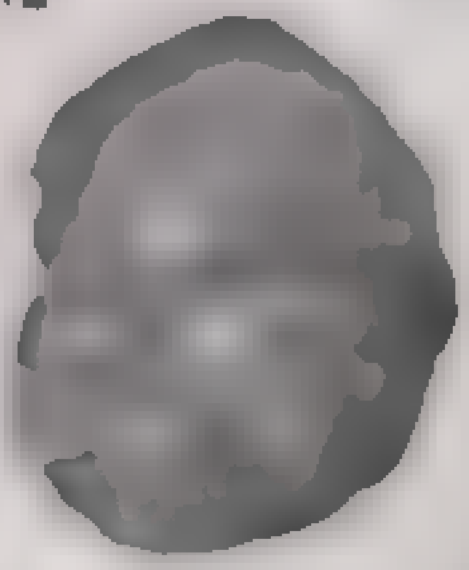
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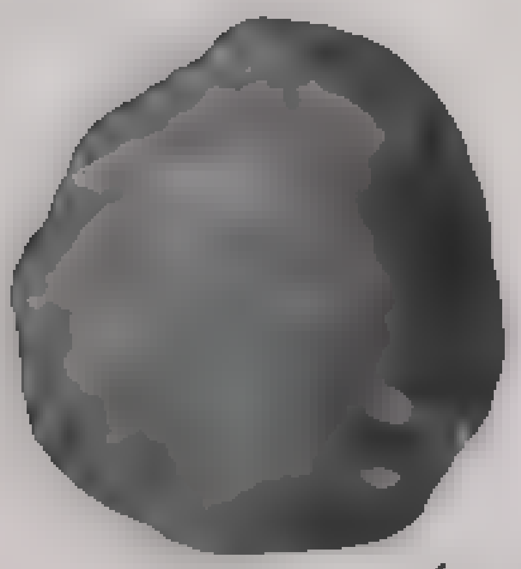
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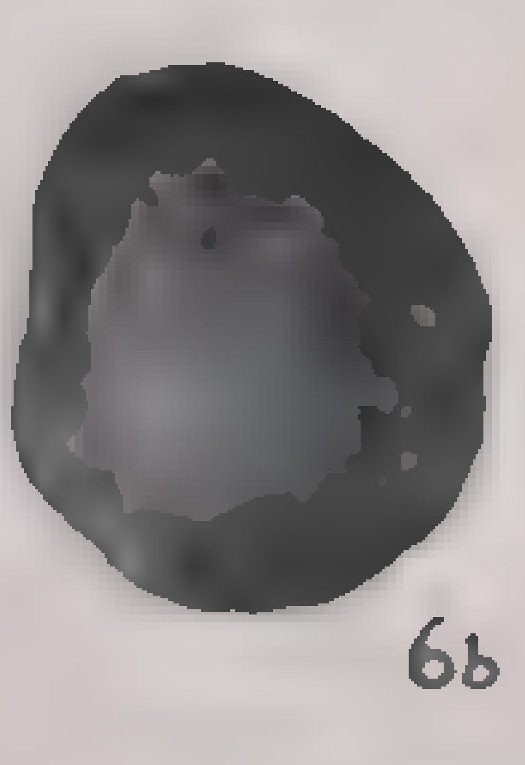
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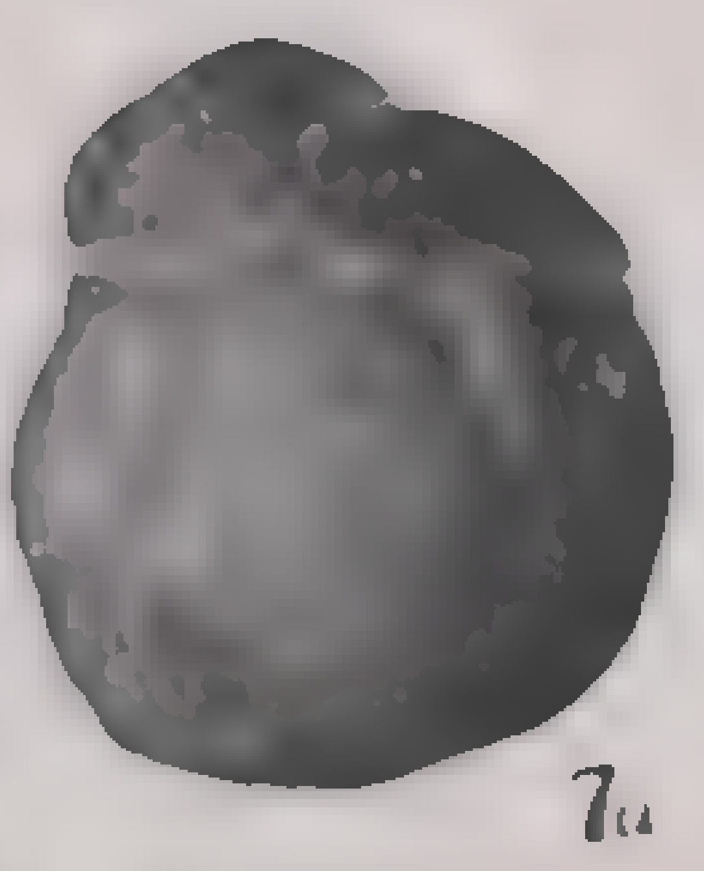
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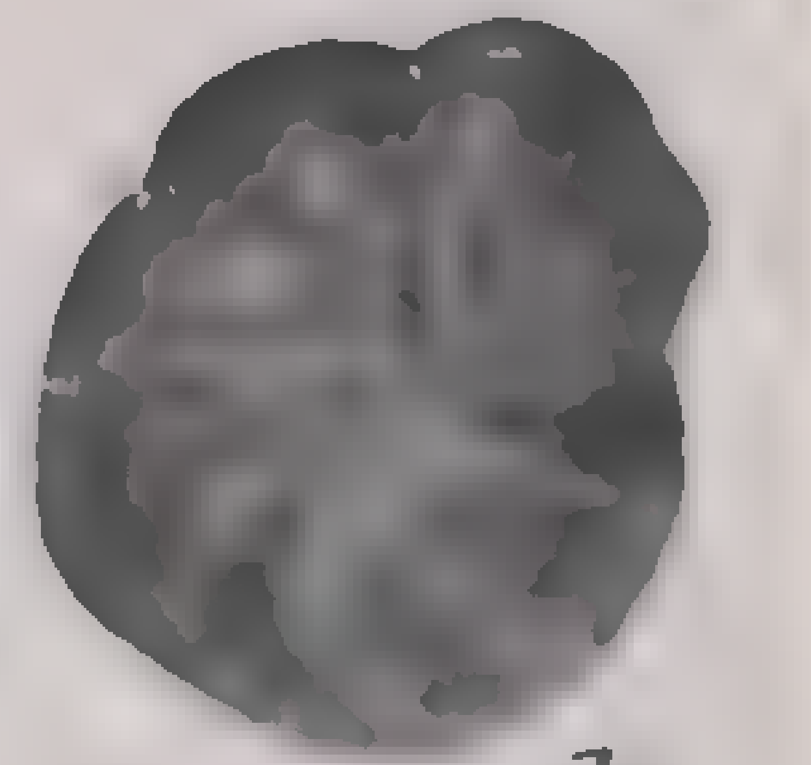
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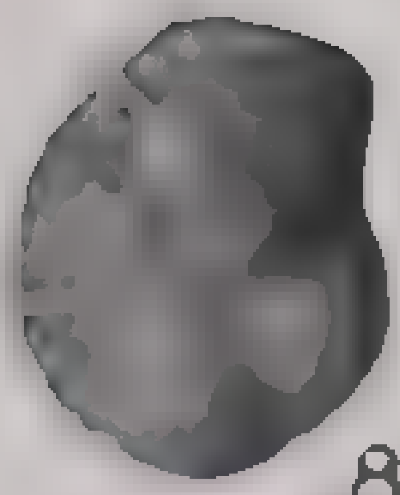
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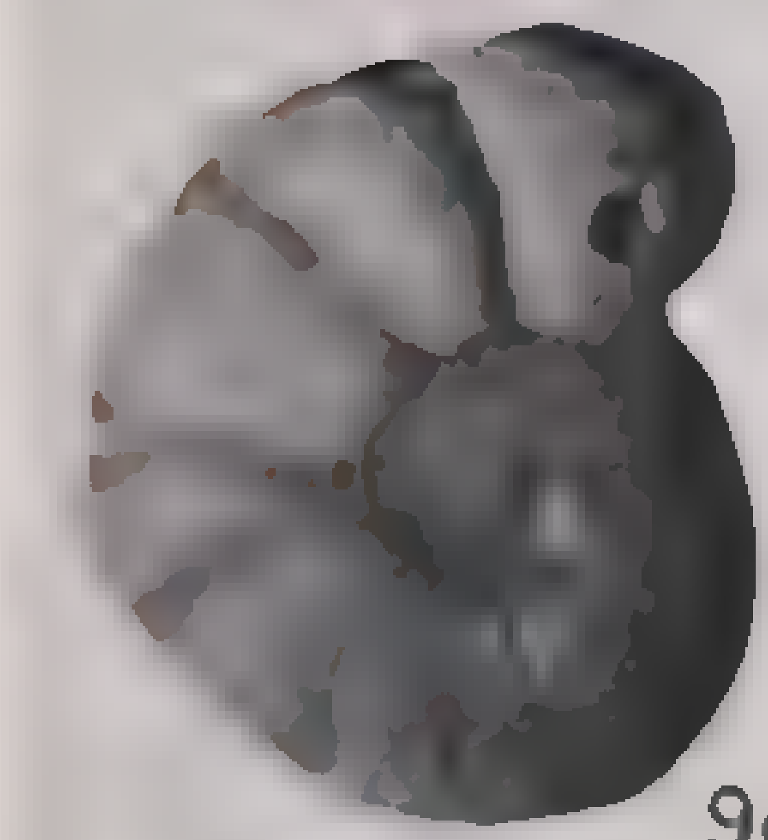
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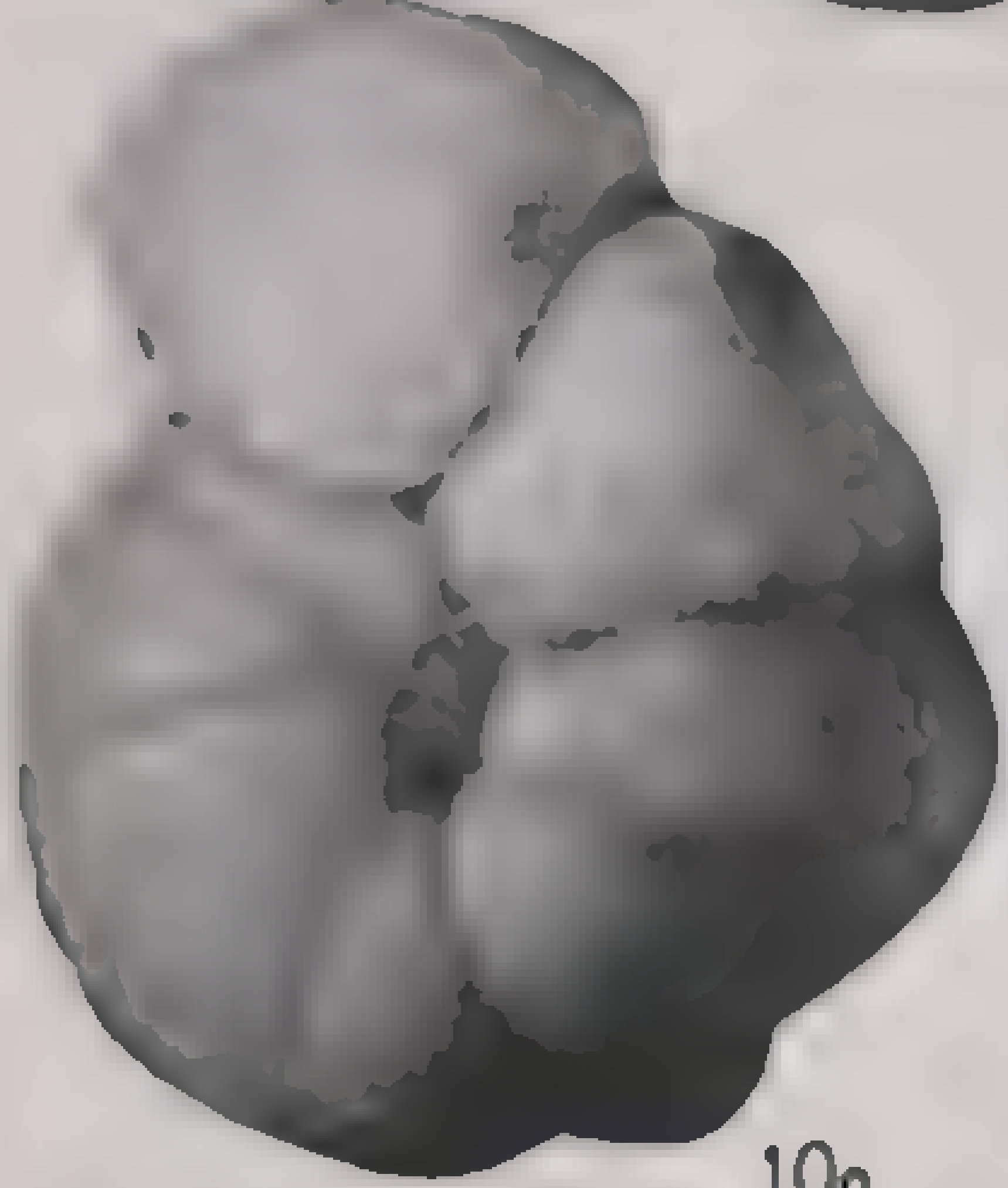
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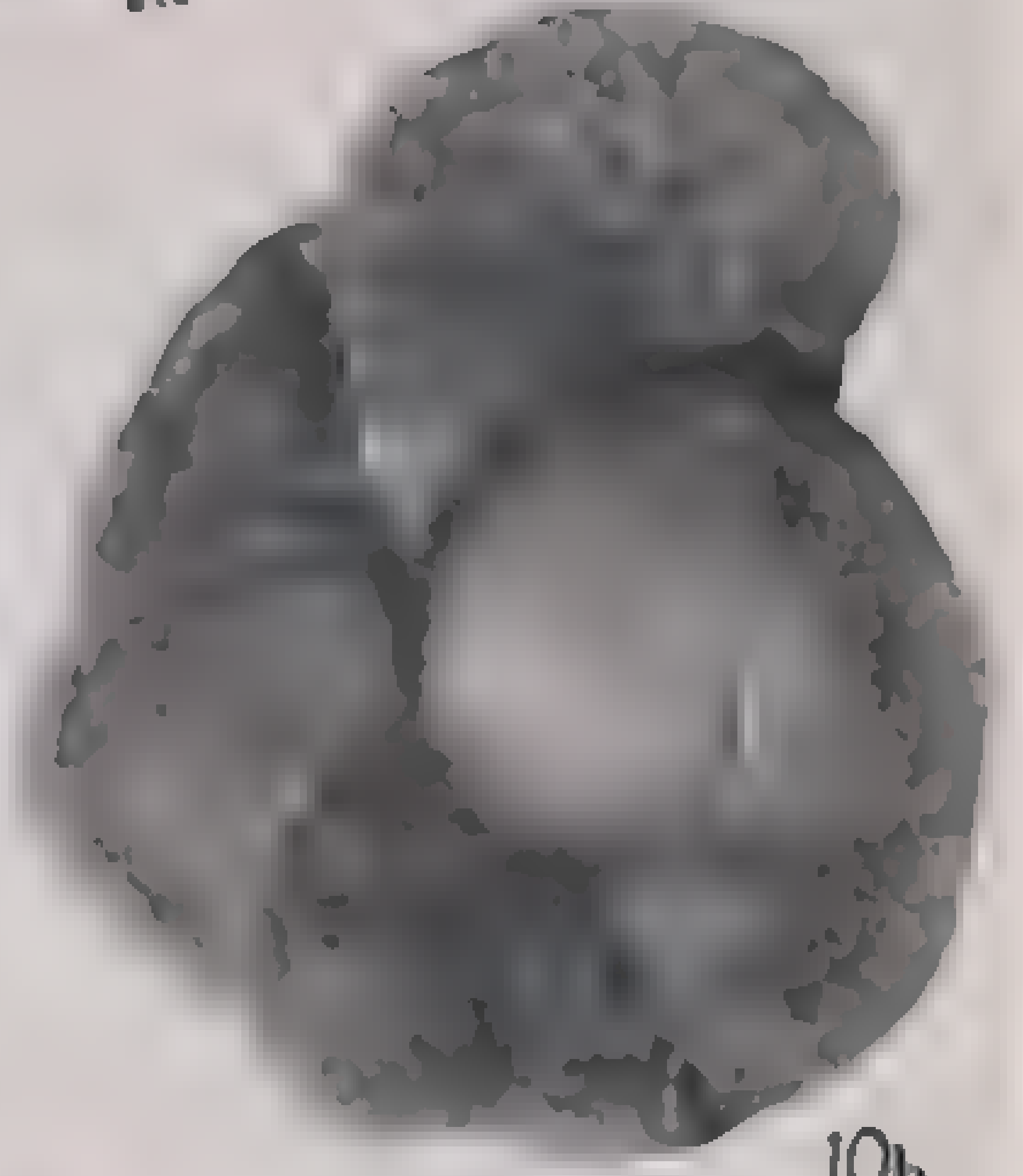
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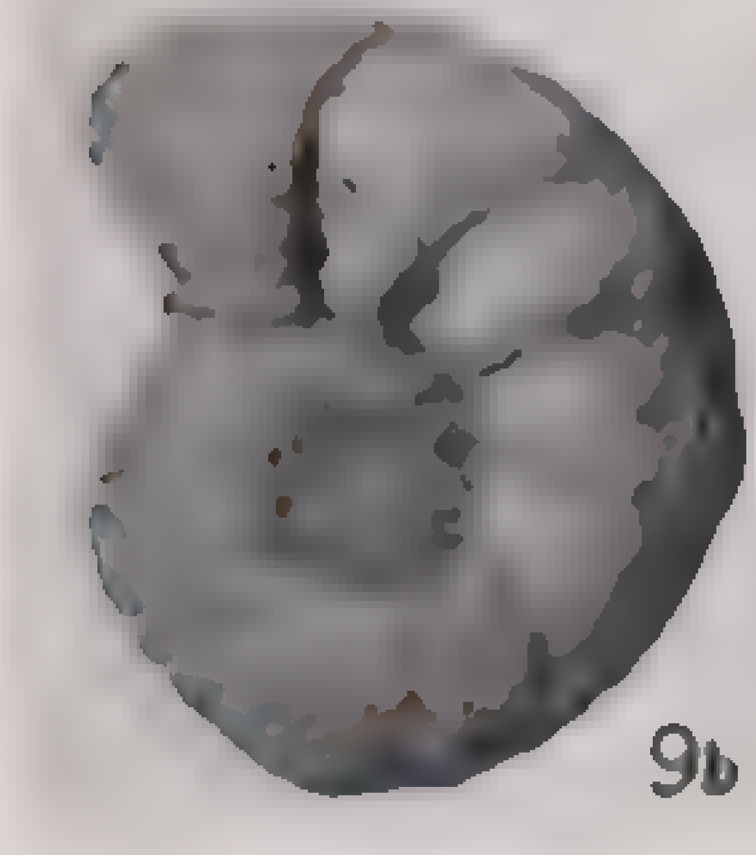
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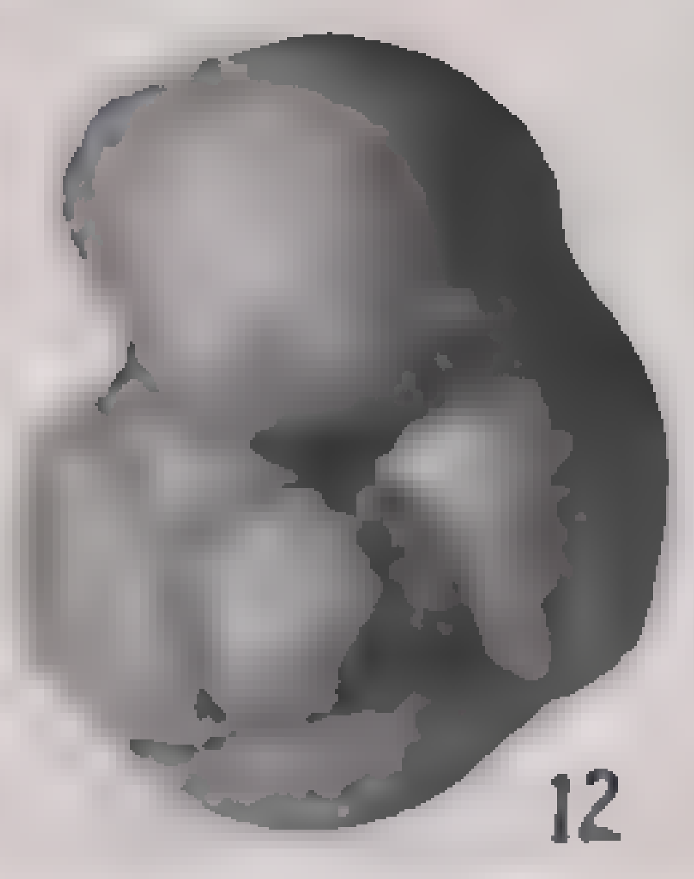
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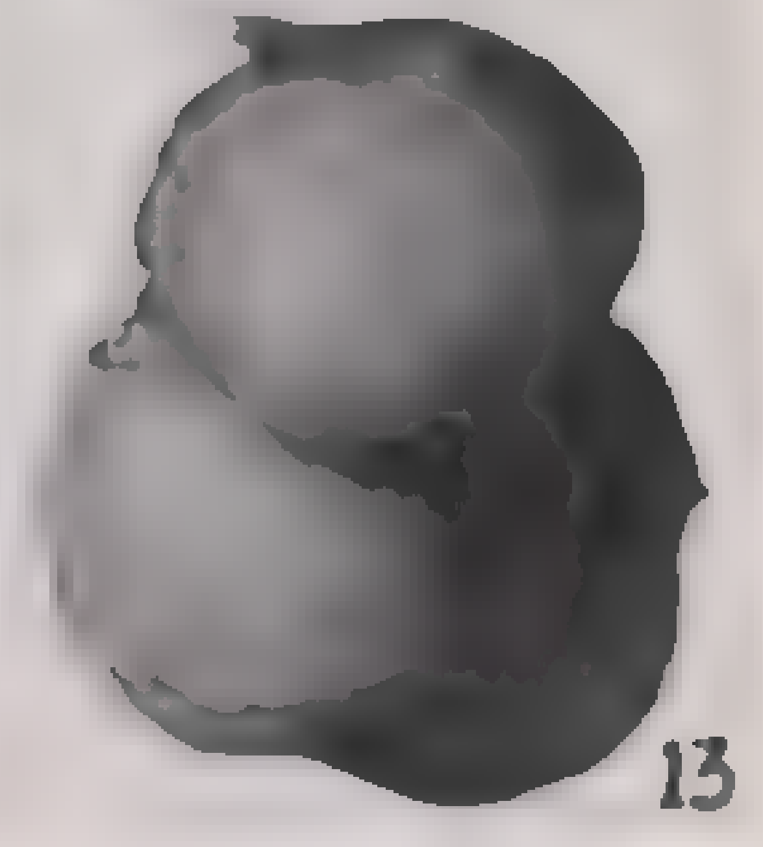
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PLATE 7

PLATE 7

Planktonic Species

Figs. 1, 2. *Globigerina bulloides* d'Orbigny. (X48.) (1) dorsal view; (2) ventral view of another specimen. Marthas Vineyard traverse, 309 m.

Fig. 3. *Sphaeroidina bulloides* d'Orbigny. (X48.) Block Id. traverse, 200 m.

Fig. 4. *Globigerinoides rubra* (d'Orbigny). (X48.) Marthas Vineyard traverse, 309 m.

Figs. 5, 6. *Globigerina eggeri* Rhumbler. (X44.) (5) dorsal view; (6) ventral view of another specimen. Marthas Vineyard traverse, 309 m.

Fig. 7. *Globigerinoides sacculifera* (H. B. Brady). (X50.) Marthas Vineyard traverse, 309 m.

Figs. 8, 9. *Globigerinoides conglobata* (H. B. Brady). (X44.) (8) dorsal view; (9) ventral view of another specimen. Marthas Vineyard traverse, 309 m.

Fig. 10. *Globorotalia menardii* (d'Orbigny). (X44.) Marthas Vineyard traverse, 309 m.

Figs. 11, 14. *Globorotalia hirsuta* (d'Orbigny). (11) (X50.); (14) (X52.). (11) dorsal view; (14) ventral view of another specimen. Block Id. traverse, 200 m.

Figs. 12, 15. *Globorotalia truncatulinoides* (d'Orbigny). (X50.) (12) dorsal view; (15) ventral view of another specimen. Marthas Vineyard traverse, 309 m.

Fig. 13. *Pulleniatina obliquiloculata* (Parker and Jones). (X48.) Marthas Vineyard traverse, 309 m.

Figs. 16, 17. *Globorotalia tumida* (H. B. Brady). (X46.) (16) ventral view; (17) dorsal view of another specimen. Marthas Vineyard traverse, 309 m.

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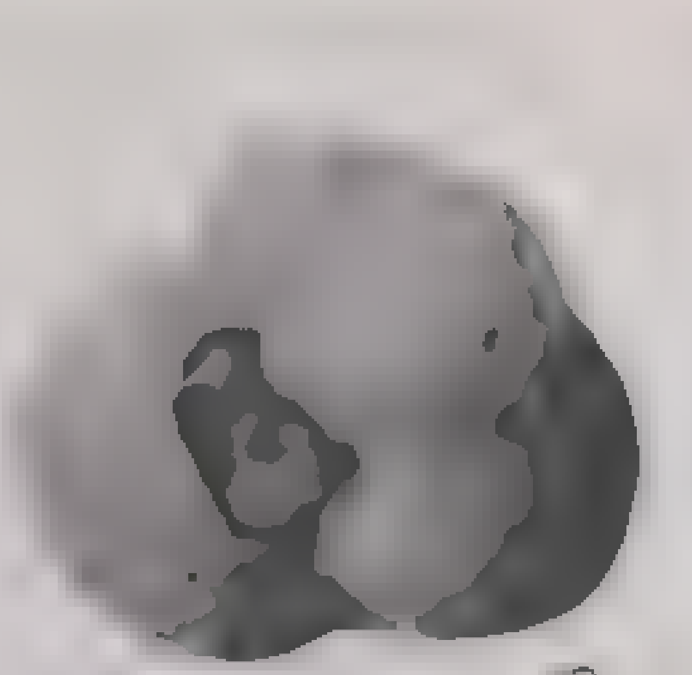
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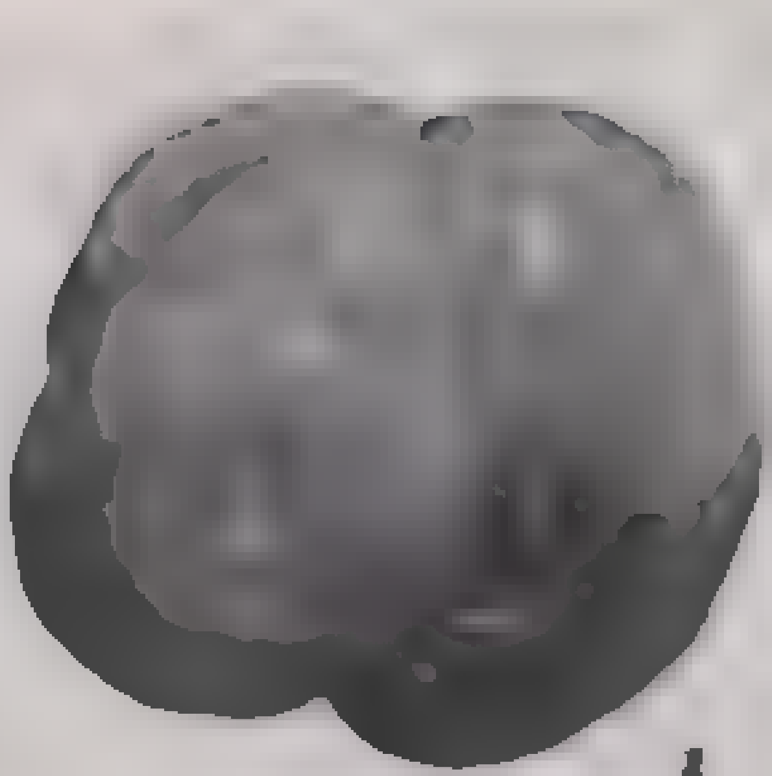
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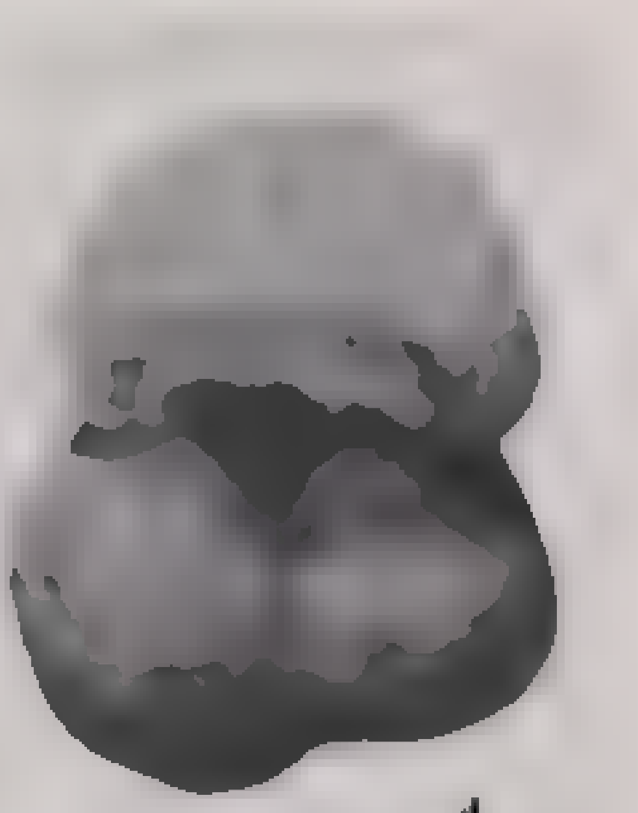
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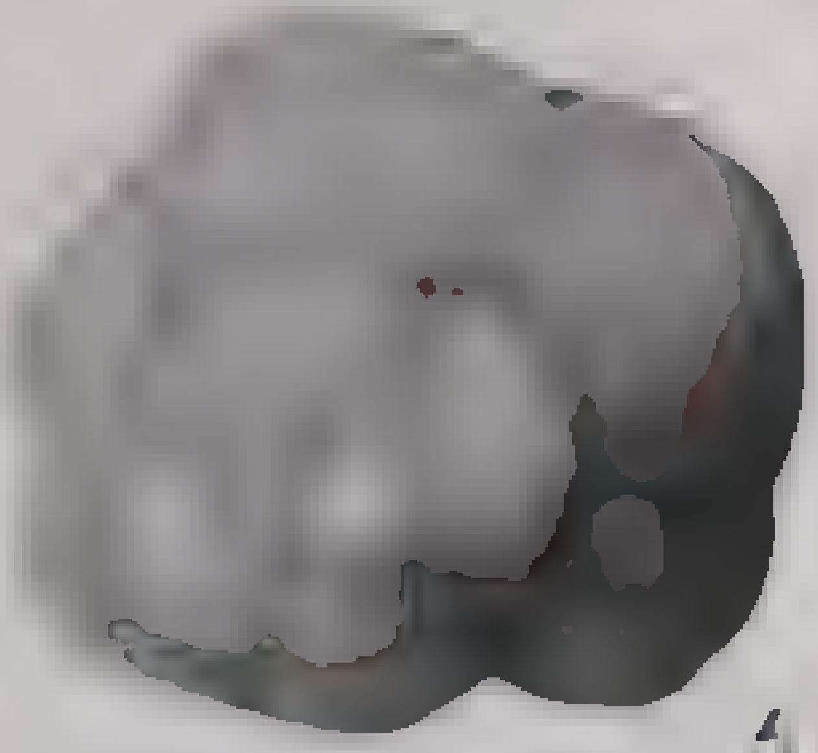
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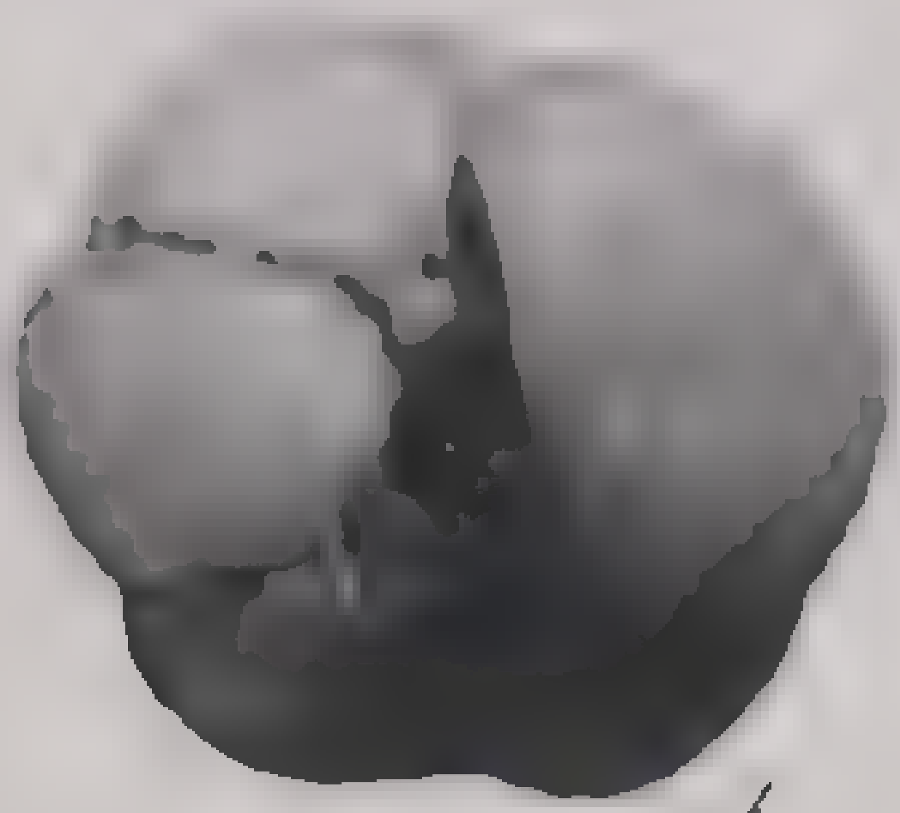
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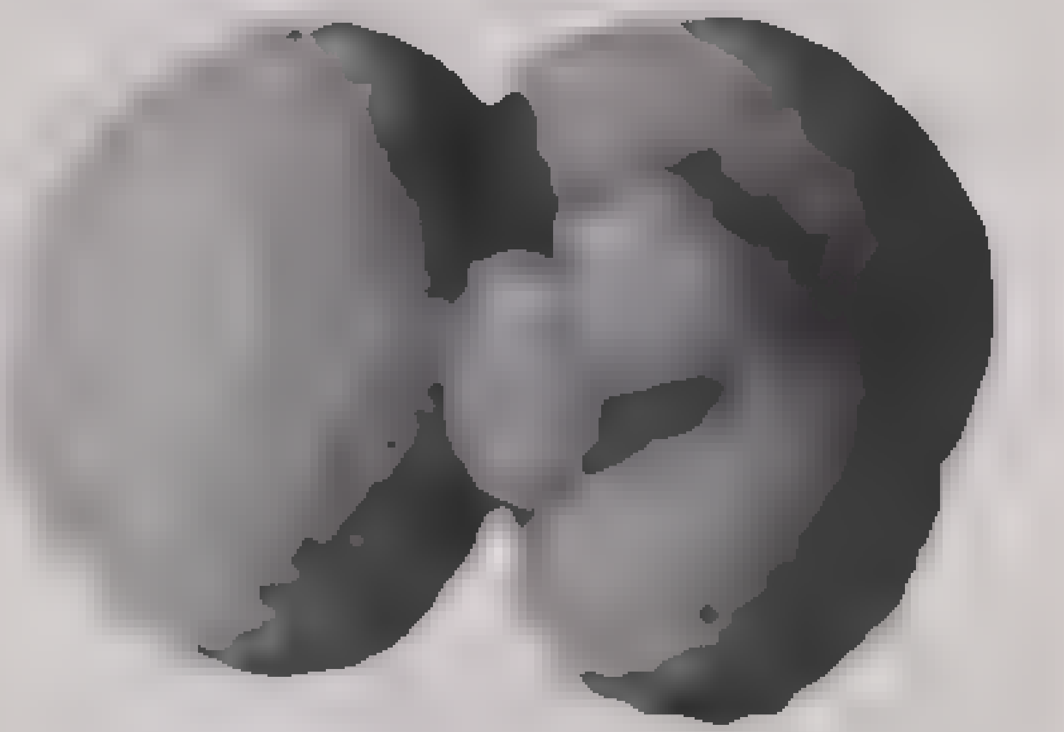
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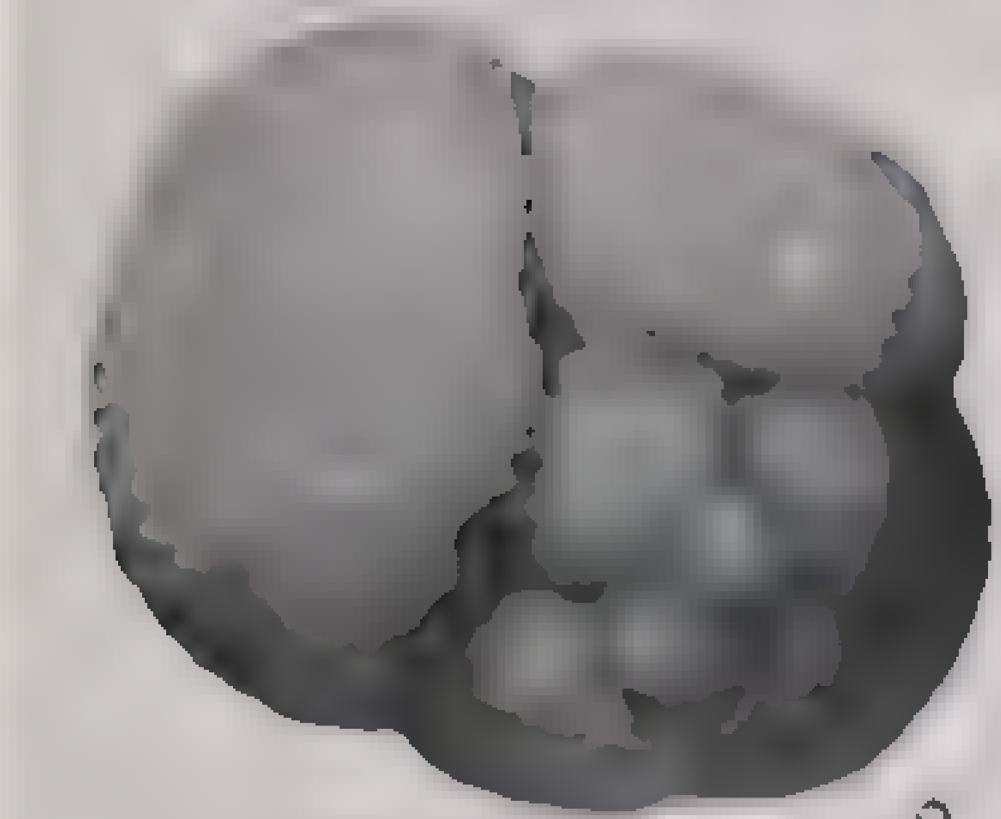
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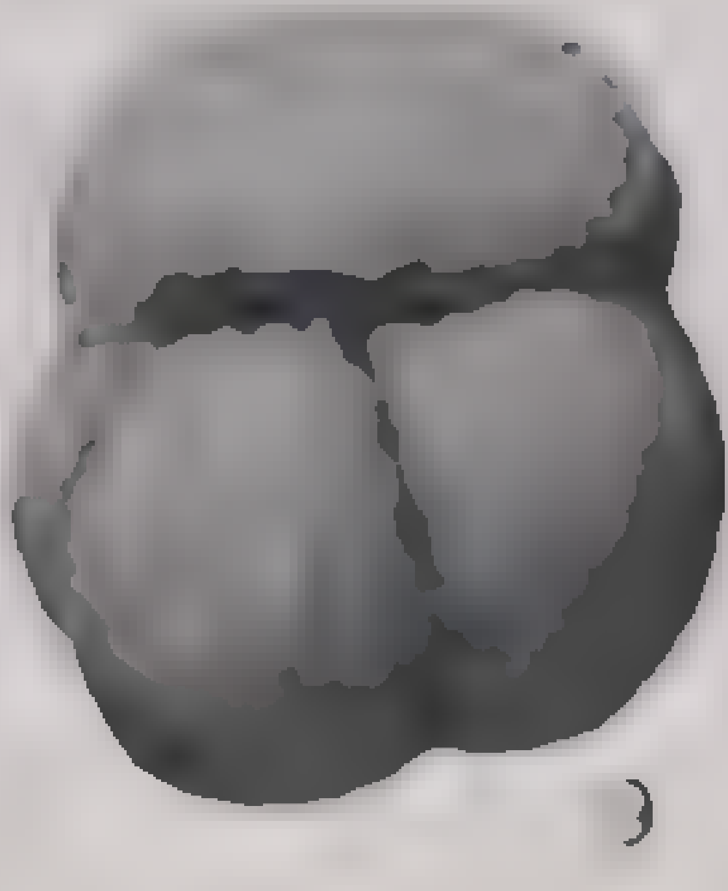
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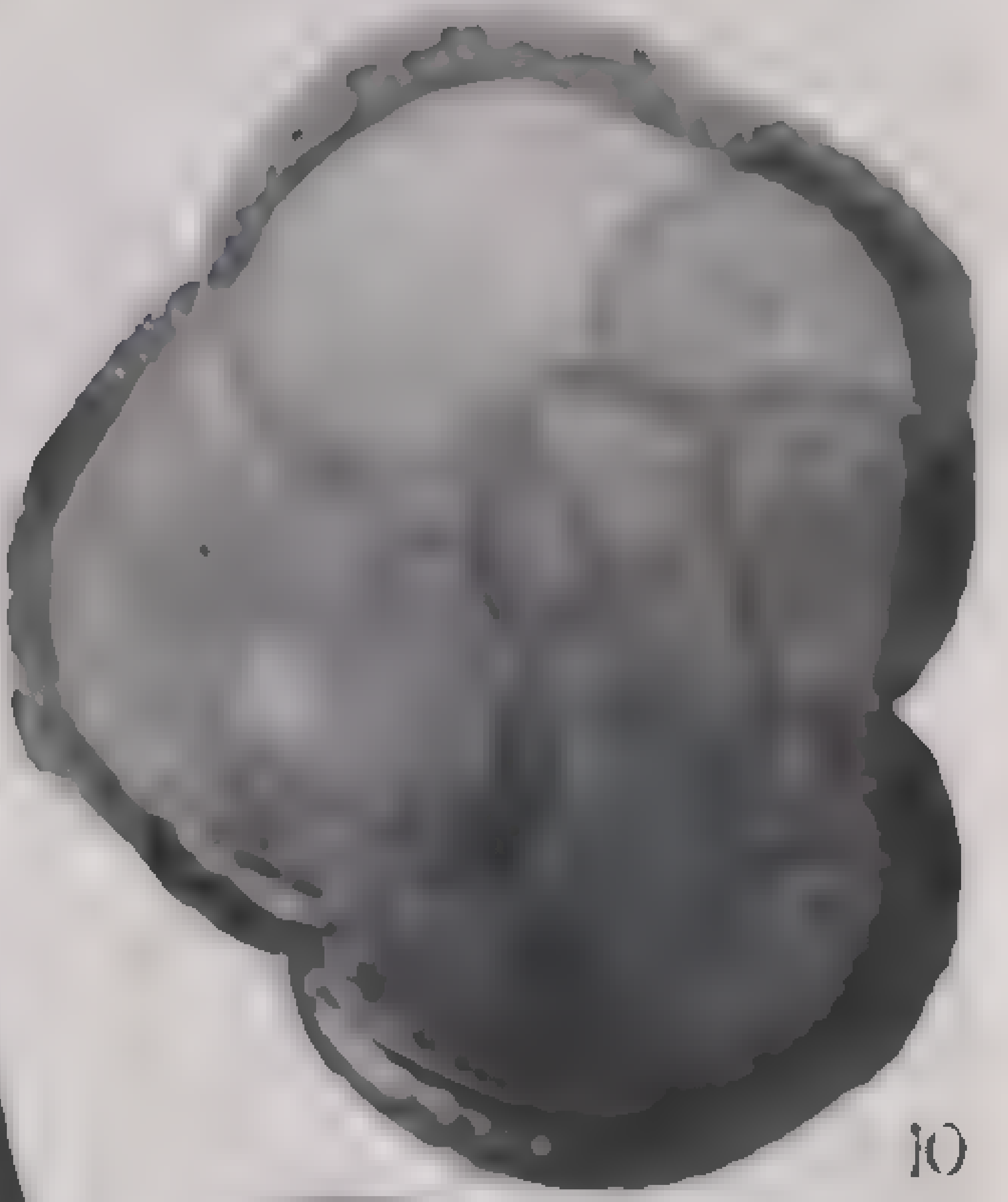
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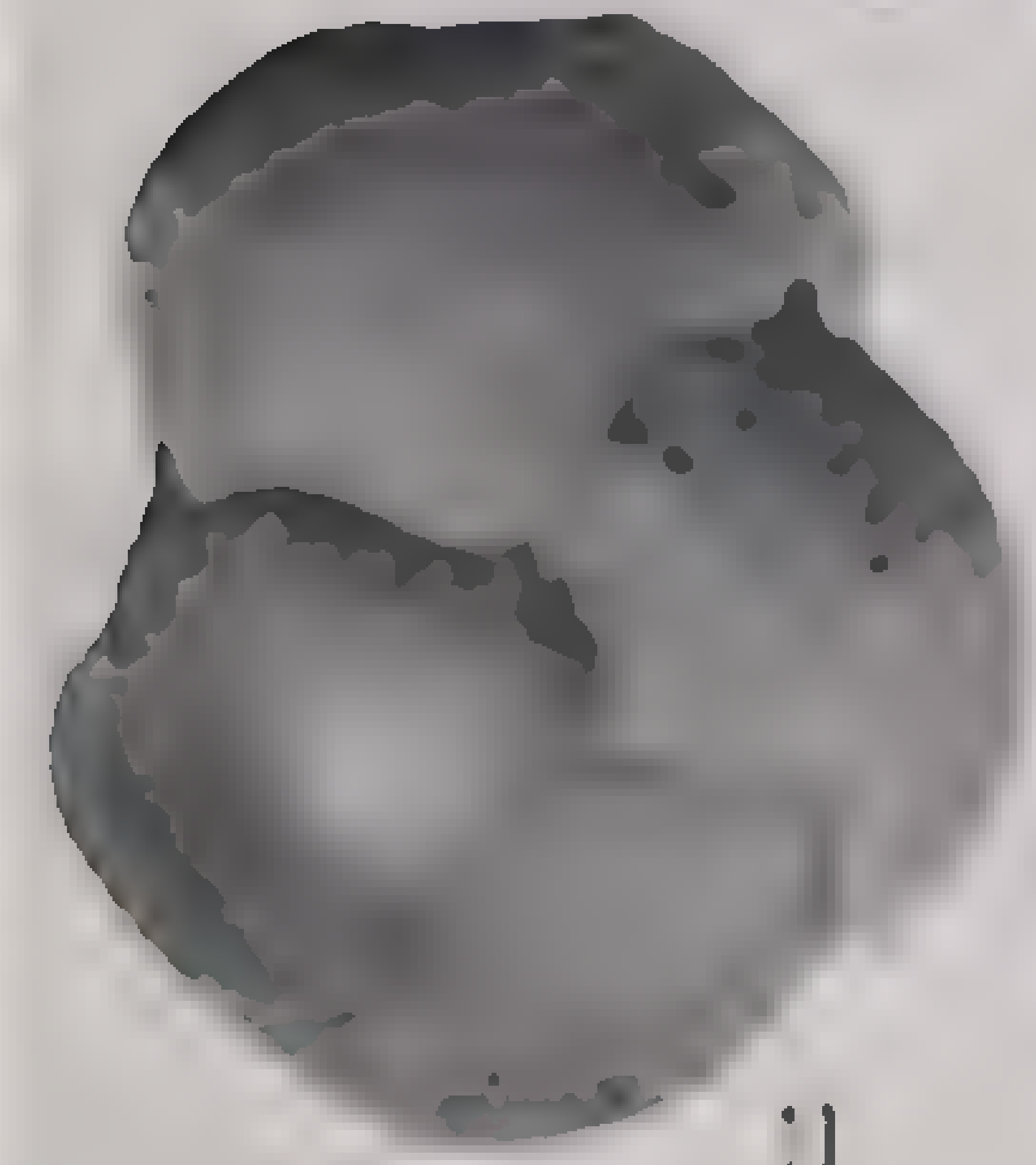
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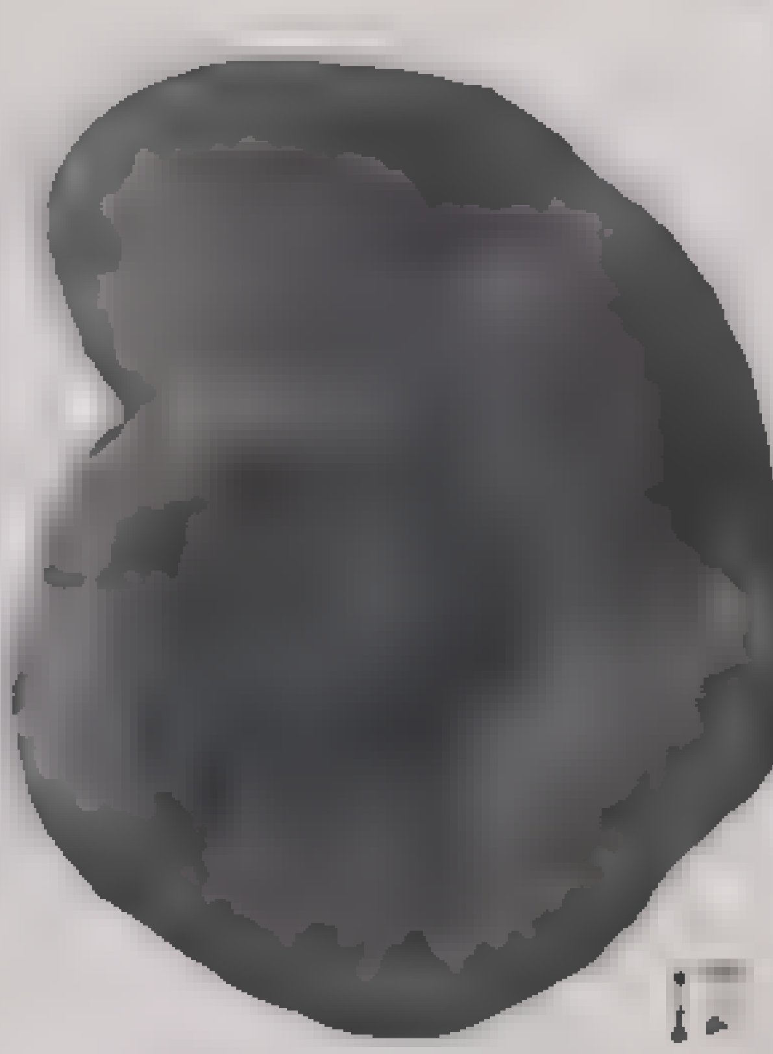
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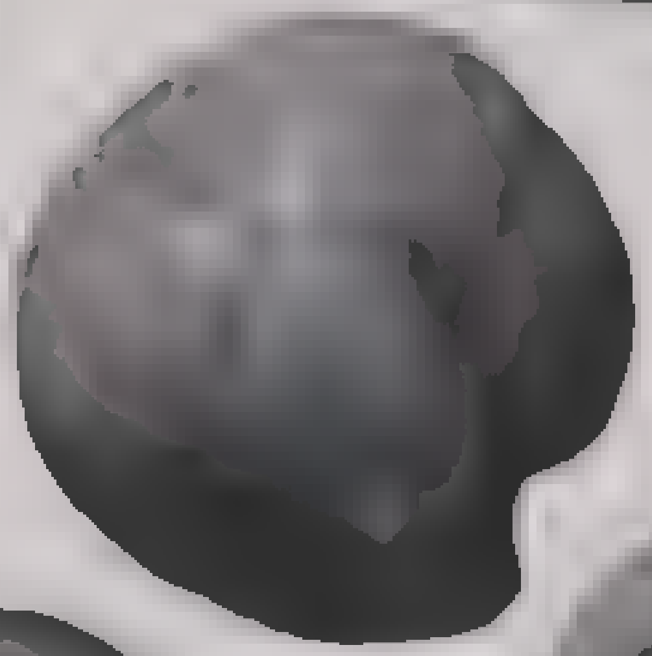
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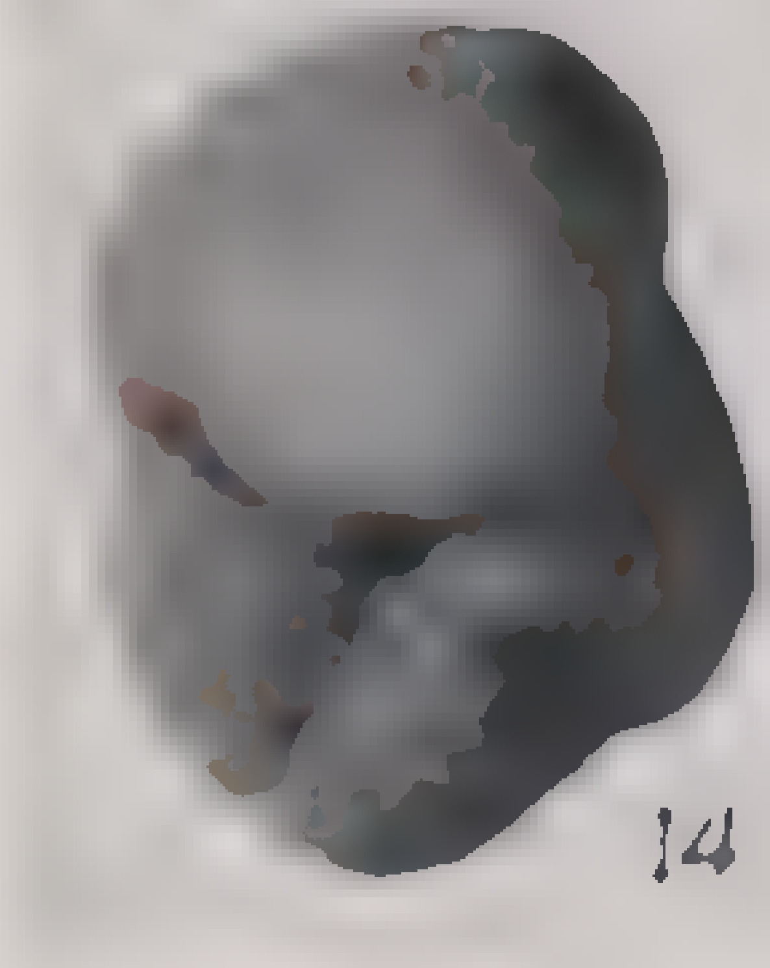
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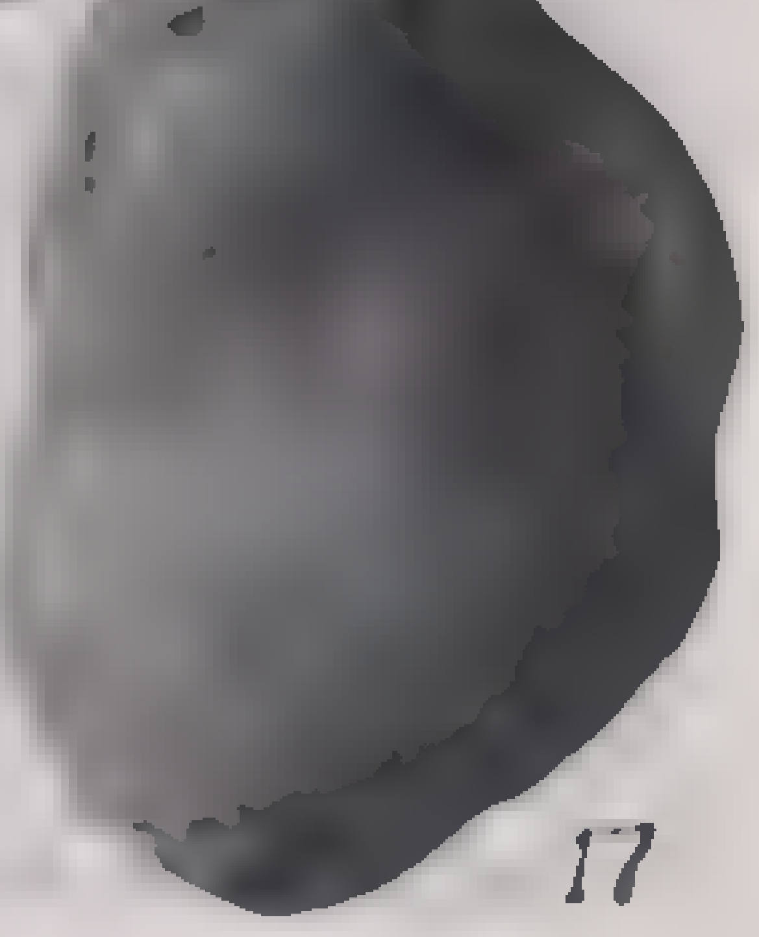
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Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
Vol. 100, No. 3

HANDBOOK OF MEDICALLY IMPORTANT MOLLUSKS OF THE ORIENT AND THE WESTERN PACIFIC

By Lieutenant R. Tucker Abbott H(S), U. S. N. R.

With Five Plates

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April, 1948

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No. 3—*Handbook of Medically Important Mollusks of the Orient and the Western Pacific*[1]

BY LIEUTENANT R. TUCKER ABBOTT H(S), U. S. N. R.[2]

TABLE OF CONTENTS

PAGE

- Introduction . . . 246
    - Acknowledgments . . . 247
- The Phylum Mollusca; Classes, Medical Importance . . . 247
- The Fresh-water Gastropoda . . . 248
    - Definition, Classes, Families . . . 248
    - Gross Anatomy and Shell . . . 250
    - Preparation of radula . . . 254
    - Parasitology . . . 255
- Trematode Diseases of Man and their Molluscan Carriers . . . 256
    - Schistosomiasis . . . 256
    - Clonorchiasis . . . 257
    - Paragonimiasis . . . 257
    - Metagonimiasis . . . 257
    - Fasciolopsiasis . . . 257
    - Incidental Trematodiases . . . 257
- Systematic Account of the Medically Important Gastropoda . . . 258
    - Family *Amnicolidae* . . . 258
        - Subfamily *Hydrobiinae* . . . 259
        - Subfamily *Buliminae* . . . 272
    - Family *Synceridae* . . . 281
    - Family *Thiaridae* . . . 285
    - Family *Planorbidae* . . . 299
        - Subfamily *Segmentininae* . . . 300
        - Subfamily *Planorbinae* . . . 303
    - Other Fresh-water Mollusks . . . 305
- The Poison Cone Shells . . . 310
- Techniques in Handling Schistosomiasis Snails . . . 312
    - Collecting . . . 312
    - Cercarial Inspection . . . 314
    - Laboratory Rearing . . . 315
- Control of the Intermediate Snail Host . . . 316

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[1] The opinions expressed in this article are those of the author and are not to be construed as official or reflecting the views of the Navy Department, or of the Naval Service at large.

[2] Malacologist, United States Naval Medical Research Unit-2.

Appendix A

Generic Discussion of *Schistosomophora, Katayama,* and *Oncomelania* 321

Appendix B

Revision of Molluscan Names Appearing in Parasitology Textbooks 324
Bibliography of *Oncomelania* 327

INTRODUCTION

This paper is presented in the form of a handbook, as an aid to parasitologists and epidemiologists whose work in the field and laboratory often calls for a simple guide to and cursory knowledge of the intermediate snail hosts of the trematodes responsible for human disease. The regions covered in this report include the Philippines, the Western Pacific Islands, China and Japan. A year's field work with United States Naval Medical Research Unit-2 (NAMRU-2) has made possible the adoption of a system of identifying the medically important mollusks of the East on the basis of the external characters of the living snail animal in combination with the method of differentiating shell characters. In this way, the often hopeless task of identifying distantly related, yet closely resembling, species by highly technical shell characters is largely eliminated by the simpler and often more accurate method of animal observation. It must be remembered, however, that the shell is merely an expression of the morphology of the snail, and that the two approaches to identification must complement each other.

Emphasis has been placed on species that have been implicated as human disease carriers, and although harmless species likely to be confused with them have been carefully considered, it will be noted that the fresh-water mollusks of no direct medical importance have been dealt with in a very superficial manner. The lists of synonyms under the various genera and species in many cases are incomplete, but enough information has been included to clarify any recent changes in nomenclature. For the parasitologist who has had no training in the field of mollusks, a minimum of information on anatomy, ecology, collecting procedures, cercarial inspection and bibliographic references has been added.

Rather than burden certain sections with lengthy taxonomic discussions, two appendices have been added at the end of this paper.

(Appendix A: A Generic Discussion of *Schistosomophora, Katayama* and *Oncomelania*. Appendix B: Revision of Molluscan Names Appearing in Parasitology Textbooks).

ACKNOWLEDGMENTS

Acknowledgments are due a number of persons and institutions, but foremost among these is Commodore Thomas Rivers, M(S)C, U.S.N.R., war-time commanding officer and organizer of Naval Medical Research Unit-2. Through his efforts the field work and the new approach to medical malacology were made possible. The Museum of Comparative Zoölogy, at Harvard College, stands foremost in its contribution of a study collection to the United States Navy, in the cooperation and guidance from its malacologists, William J. Clench and Joseph C. Bequaert, and in its willingness to publish this paper in its present form. The author wishes to thank the various members of the United States National Museum for their cooperation and time — Doctor Alexander Wetmore, Director; Doctor Paul Bartsch, Curator Emeritus of the Mollusk Division; Doctor Harald A. Rehder, Curator; and Doctor Joseph P. E. Morrison Associate Curator. The editor of Occasional Papers on Mollusks, W. J. Clench, has kindly given permission to reproduce plate 5 and text figures 1, 3 and 4. The author wishes to record the limitless cooperation received from various members of the U. S. Army and U. S. Public Health Service in the Philippine Area. Among the many were Colonel Willard W. Wright, Major Fred Bang, Doctor Donald McMullen, Captain H. Graham and Captain M. S. Ferguson.

THE PHYLUM MOLLUSCA

The five classes of Mollusca include the Gastropoda (snails, slugs, etc.), the Lamellibranchia (clams, mussels, etc.), the Cephalopoda (squids, octopus, etc.) and the small classes, Scaphopoda (marine tusk shells) and Amphineura (marine chitons or "suck-rocks").

It is only within the last 60 years that the medical role of mollusks has become known. The knowledge that many fresh-water gastropods are the obligatory intermediate hosts of trematode worms has closely linked certain phases of malacology with the medically important field of helminthology. Although nearly every kind of mollusk is parasitised by adult or larval forms of helminths, and although many mollusks are parasitic themselves, relatively few are of medical importance, and these in almost every known case are among the fresh-water Gastropoda. Exceptions to this are the poison cone shells; the marine mussels that have caused food poisoning; the fresh-water clams *Corbicula* and *Sphaerium* which serve as secondary intermediate hosts for *Echinostoma*; and a few species of land gastropods in Europe which serve as the intermediate host of *Dicrocoelium*.

THE FRESH-WATER GASTROPODA

The class Gastropoda, the group containing the snails and slugs, consists of forms with a bisymmetrical organization, with a well-developed head, usually bearing tentacles, with a mantle, and generally with an external shell which is spirally coiled. There are two subclasses, divided on the basis of the pattern of the nervous system; one, the **Streptoneura,** has its visceral nerve commissure twisted into a figure "8"; in the other, **Euthyneura,** the visceral nerve loop is not crossed.

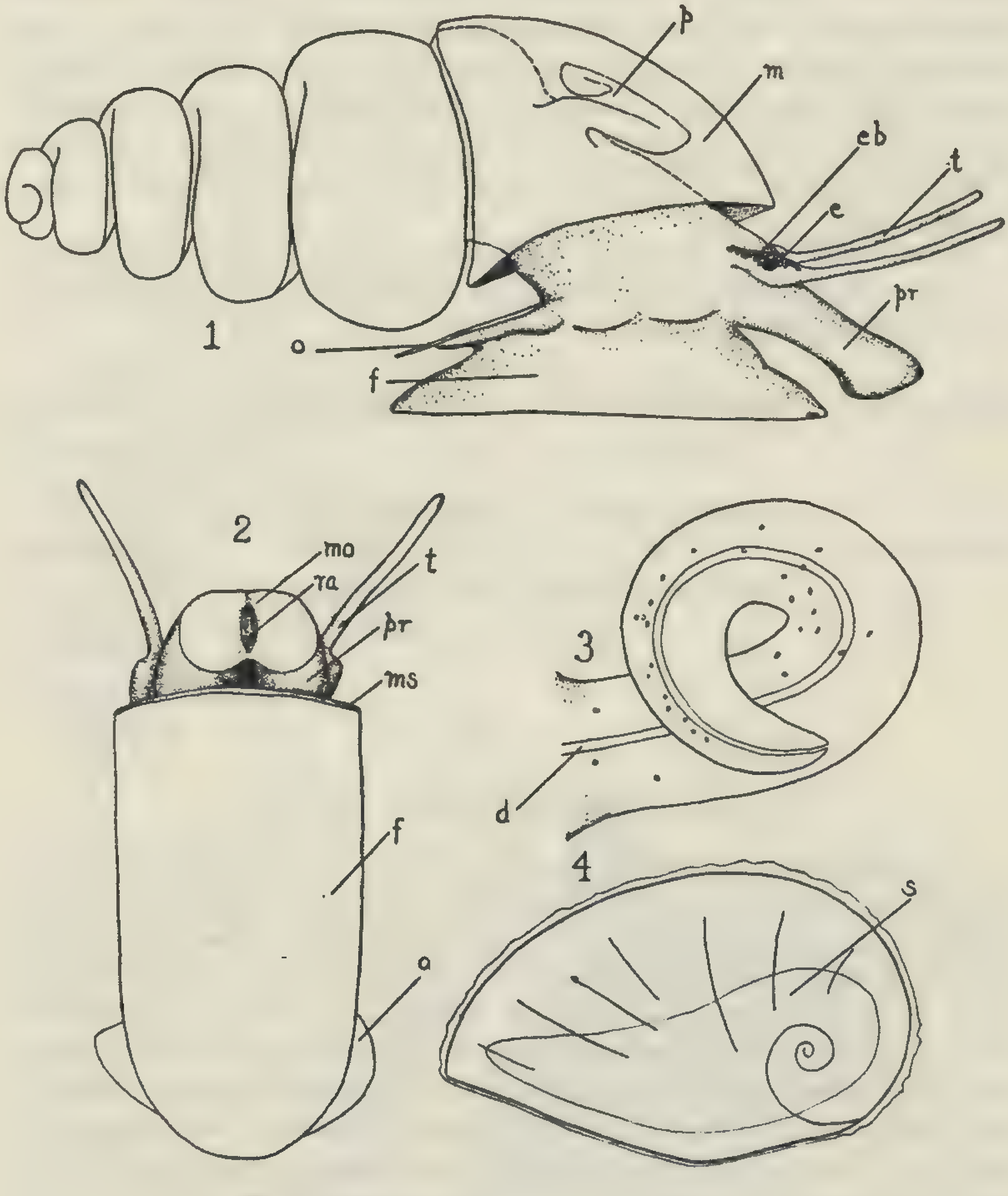
The subclass **Euthyneura** contains the order **Pulmonata,** which are air breathing mollusks, provided with a lung and breathing orifice and lacking gills and generally an operculum. The **Pulmonata** are divided into two suborders: (1) **Stylommatophora** (slugs, garden snails, land snails) which are characterized by their two pairs of tentacles, with eyes at the tip of the second pair. (2) **Basommatophora** (pond snails, *Lymnaea*, *Planorbis*, etc.) which have one pair of tentacles with an eye at the base and, although mostly aquatic, possess an air breathing lung. Some forms, however, have secondarily acquired gills, which may exist together with the lung (*Planorbidae*).

The subclass **Streptoneura,** members of which have gills, contains two orders: (1) the **Scutibranchiata** include, besides several marine families, the fresh-water *Neritidae* and *Hydrocenidae*, which, however, have not yet been involved in human trematode infections. The

---

Fig. 1. (1). Side view of living animal of *Oncomelania* with shell removed in drawing. (2). Underside of foot and head. (3). Verge or penis of male. (4). Operculum, top side. (5). Looking back under the mantle showing gills on left wall. (6). Dorsal view of animal with right side of mantle cut and laid back to show gills and rectum attached to inside of mantle.

d = sperm duct; e = eye; eb = yellow "eyebrow" color granules; f = foot; fi = gill filaments or para-ctenidial folds; la = gill lamella; m = mantle; mo = mouth; ms = mucous slit; o = operculum; p = penis; pr = proboscis or snout; ra = radula ribbon; re = rectum; s = muscular attachment scar; t = tentacle.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fi
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Fig 1. Explanation on opposite page.

radulae are complex with numerous marginals. (2) the **Pectinibranchiata** include most of the marine gastropods and many of the fresh-water species which serve as intermediate hosts of human trematodes. Gills are present, and most forms (suborder **Taenioglossa**) have seven rows of teeth in the radula, while others (suborder **Stenoglossa**) have only three rows, a pallial siphon and sometimes a "poison gland".

The Oriental and Western Pacific fresh-water gastropods belong to the following eleven families, those marked with an asterisk being of medical importance.

	ORDERS	SUB-ORDERS	FAMILIES
Euthyneura	**Pulmonata**	**Basommatophora**	*Lymnaeidae**
			*Planorbidae**
			Bulinidae
Streptoneura	**Scutibranchiata**	**Rhipidoglossa**	*Neritidae*
			Hydrocenidae
	Pectinibranchiata	**Taenioglossa**	*Pilidae*
			Viviparidae
			*Amnicolidae**
			Rissoidae
			*Synceridae**
			*Thiaridae**

GROSS ANATOMY AND SHELL

The three external divisions of the body of the gastropod, the head, foot and mantle, are well defined. The head is well developed, and forms a more or less cylindrical mass (*Thiaridae*, *Amnicolidae*, etc.) or is sometimes flattened (*Planorbidae*, *Lymnaeidae*). In the fresh-water gastropods there is one pair of tentacles, varying greatly in different groups. They are long, slender and with eyes at their bases, as in the *Thiaridae* and *Amnicolidae*, or very short, and welded to the eye stalk, as in the *Synceridae*. It is only in certain marine groups and in all land snails that the eyes are situated at the free end of one of two pairs of tentacles. At the anterior end of the head is the mouth which is usually surrounded by a muscular proboscis.

The **foot.** On the ventral side of the gastropod is the large muscular foot which is used for locomotion. In most cases the foot has a simple (undivided) flat sole for creeping. At the anterior end there is a narrow slit from which the contents of the mucus glands exude to aid locomotion. In *Syncera* there is a deep furrow on each side of the neck running posteriorly from the juncture of the proboscis and foot. In *Stenothyra* the posterior end of the foot carries a small, fleshy tentacle on the dorsal side.

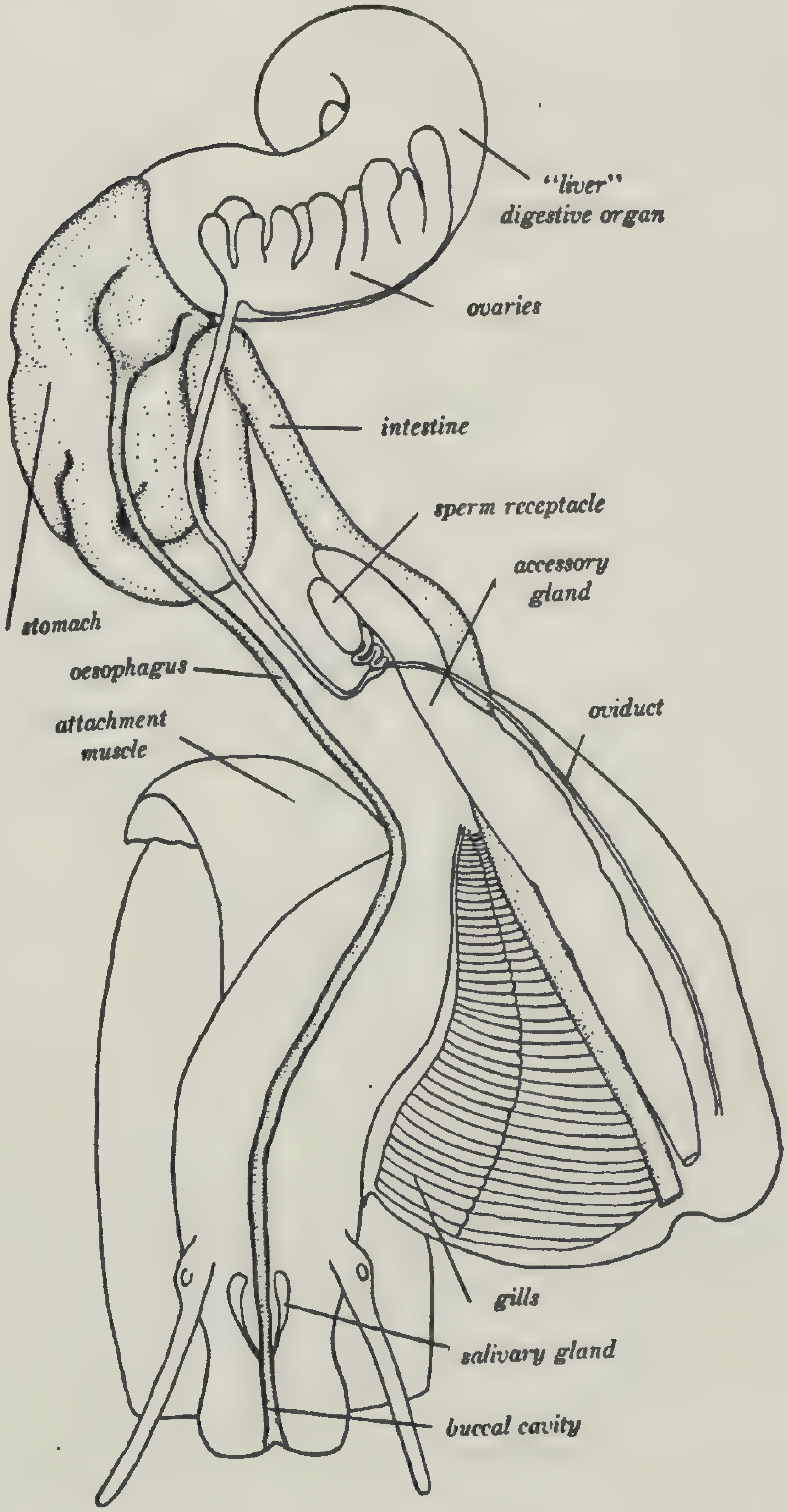
"liver"
digestive organ
ovaries
intestine
sperm receptacle
accessory
gland
stomach
oesophagus
attachment
muscle
oviduct
gills
salivary gland
buccal cavity

Fig. 2. Semi-diagramatic drawing of alimentary and female reproductive system of *Oncomelania quadrasi* Moellendorff.

In the fresh-water Pulmonata (*Lymnaea, Planorbis, Bulinus*) the foot does not bear an **operculum,** but in all the Streptoneura (*Thiaridae, Amnicolidae, Neritidae, Viviparidae,* etc.), there is an operculum attached to the dorsal side of the posterior end of the foot. When the animal is withdrawn into its shell, this corneous or calcareous plate serves as a protective "trapdoor". As a rule it fits snugly into the aperture (*Oncomelania, Syncera, Viviparidae*) or is a little larger than the aperture (*Bulimus, Parafossarulus, Alocinma,* etc.). In the *Thiaridae* it is generally smaller. In various genera the operculum is either calcareous and hard or corneous and pliable.

The **mantle.** Covering the visceral sac and freely projecting down like a hood over the head and body of the gastropod, is the thin fleshy mantle. The open space between the mantle and the body of the animal is known as the mantle or pallial cavity, into which lead the apertures of the anus and the renal ducts; and, as it also contains the gills or ctenidial branchiae, it constitutes the respiratory cavity. This pallial cavity is much reduced in the pulmonates, as the result of the almost complete fusion of the mantle border with the neck.

The mantle border in most fresh-water gastropods (*Oncomelania, Thiara,* etc.) projects somewhat beyond the shell that covers it, and may be furnished with little tentacles or papillae (*Thiara*), and with glands for producing new layers and pigmentation in the shell. In *Lymnaea* and *Myxas,* the mantle is extended and folded back over the outer surfaces of the shell when the animal is expanded. The dorsal surface of the mantle also secretes shell material, formed of a single piece, which necessarily reproduces the form of the mantle, or rather of the visceral sac contained in the mantle.

The gastropods are attached to their shells by the columellar muscle (Fig. 2), and withdraw themselves into their shells by its contraction.

The **alimentary canal.** This consists of a buccal cavity which opens at the extremity of the head, which generally has the form of a cylindrical snout. The salivary glands open into the buccal or pharyngeal cavity. At the anterior end are solid cuticular thickenings called the mandibles. Behind this the radula ribbon is located.

The **radula** is a long, thin ribbon formed of distinct and separate hard teeth, borne on a single supporting membrane. The radular ribbon is supported by a system of paired cartilaginous pieces furnished with protractor and retractor muscles, the action of which causes the radula to move back and forth and work like a rasp on the object on which the animal is feeding. The teeth are disposed in transverse rows, and in each row there is a central tooth called the "rachidian tooth," on either side of which the remaining teeth of the row are symmetrically arranged. In the Euthyneura all the lateral teeth are generally similar to one another, but in the Streptoneura they are divided into two clearly defined groups. The teeth next to the rachidian are the "laterals", and differ in shape from the more elongated external teeth, which are known as the "marginals". The number of teeth in any given transverse row is constant in a given species, but usually variable from genus to genus or, in a few cases, from species to species. The number of successive transverse rows also varies from species to species.

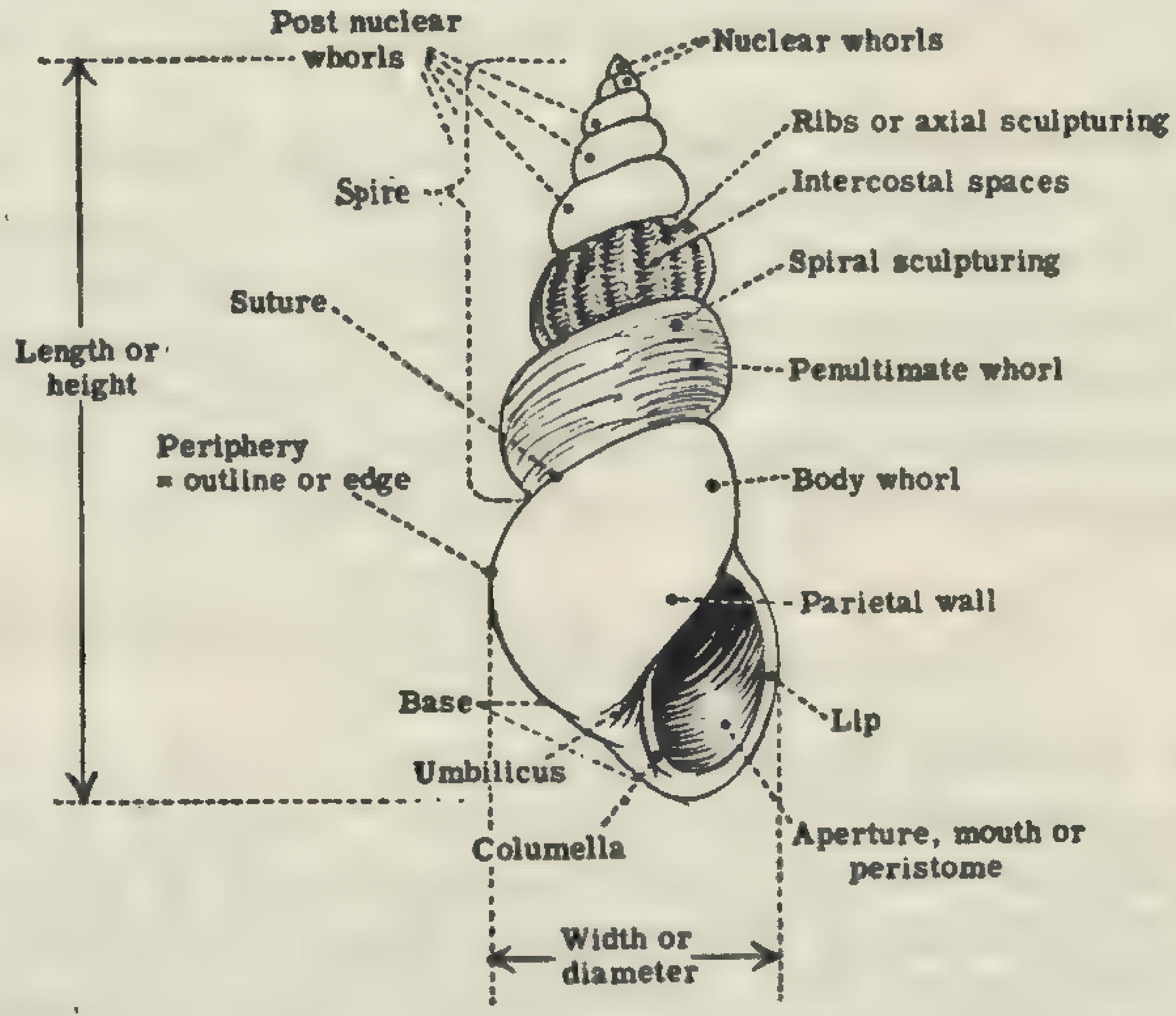
MOLLUSCAN NOMENCLATURE
Post nuclear whorls
Nuclear whorls
Ribs or axial sculpturing
Intercostal spaces
Spire
Spiral sculpturing
Suture
Length or height
Penultimate whorl
Periphery = outline or edge
Body whorl
Parietal wall
Base
Lip
Umbilicus
Columella
Aperture, mouth or peristome
Width or diameter

Fig. 3. Periostracum: thin protective coating or "skin" over the outside of shell. Operculum: corneous thin trapdoor attached to foot of animal. Fits snugly into aperture. Varix: thickening of shell just behind the lip on the outside body whorl.

Radulae are important in systematic work, but often they may vary in the individuals in form and number of tiny denticles located on each tooth; and groups of snails fairly far apart from one another may exhibit analogous features in the radula teeth.

The **oesophagus** is generally long and with plicated walls. The **stomach** proper consists of a simple enlargement of the digestive canal, and its walls are normally thin. The internal wall, however, may be lined by a more or less thick and extensive cuticle. With this thin transparent lining in *Oncomelanis,* there is an elongate, clear crystalline style which aids in digestion.

The "liver" or **digestive gland** is located in the spire of the shell and constitutes the essential organ of digestion. It is closely connected with the posterior end of the stomach.

The **heart** is always dorsal and in the immediate posterior neighborhood of the respiratory apparatus. The gastropods in general have a well-developed arterial system, but the venous system is for the most part lacunar.

Reproductive organs. The Streptoneura are dioecious with the exception of a few genera. All the Euthyneura are monoecious. In dioecious gastropods the males are externally recognizable only by the penis, when this organ exists. The gonad is always unpaired and is embedded in the liver. It has the form of a racemose gland, made up of a great number of acini, and it may be compact or arborescent, with ramifications extending over and into the liver mass.

PREPARATION OF RADULA

In a few instances, the parasitologist may wish to examine the radula of a snail to aid in its identification. Although permanent mounts are not necessary for this type of work, it is advisable to preserve a few animals in 70% alcohol for later and more critical study by malacologists. The most successful temporary mounts are made in fresh-water. The shell is crushed under water and the animal extracted alive; in the case of *Oncomelania* or *Syncera* the snails are narcotized by sealing them in a vial overnight with one or two small crystals of menthol. Under the dissecting microscope, and set in a shallow glass dish of water, the flesh of the proboscis is torn and prodded away from the radula ribbon (See fig. 1, *pr, ra, mo,* and fig. 4). Minute insect pins set in wooden or stainless steel holders are ideal for dissecting. As much of the flesh as possible should be teased from the ribbon. If, as is the case in preserved or dried animals, the flesh will not completely come away, the ribbon is soaked for a few minutes in a saturated solution of potassium hydroxide (KOH). The cleaned radula is put in a drop of water on the glass microscope slide, and over this is placed the cover slip. Drops of water from a pipette are added from time to time to prevent drying. The cover slip may be nudged back and forth to rotate, overturn, or break loose the individual teeth in the ribbon. A simple permanent mount can be made by allowing the slide to dry overnight, and by then gently lifting the cover slip up, so that a drop or two of euparol or diaphane can be added. Staining is not necessary. If Canada Balsam is used for permanent mounting, the radula ribbon must be brought from water up through varying strengths of alcohol to absolute alcohol.

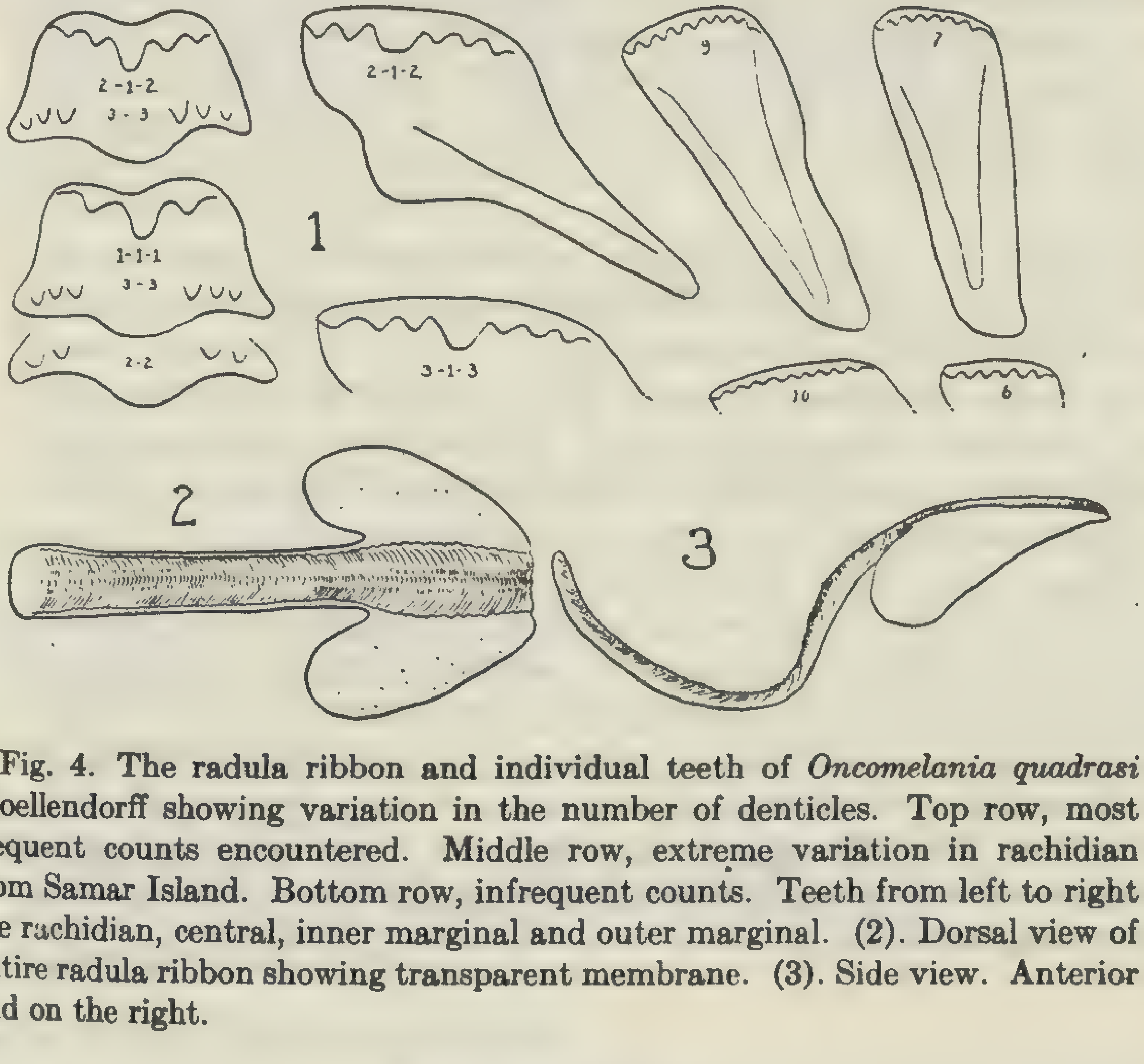

Fig. 4. The radula ribbon and individual teeth of *Oncomelania quadrasi* Moellendorff showing variation in the number of denticles. Top row, most frequent counts encountered. Middle row, extreme variation in rachidian from Samar Island. Bottom row, infrequent counts. Teeth from left to right are rachidian, central, inner marginal and outer marginal. (2). Dorsal view of entire radula ribbon showing transparent membrane. (3). Side view. Anterior end on the right.

PARASITOLOGY

All species of trematodes parasitic in man have gastropods as obligatory intermediate hosts. The various species of trematodes have each become adapted to a single or at most a few species of snails. With other species of snails the miracidia either are not attracted, or fail to penetrate, or else do not complete their larval development. A few snails are capable of experimental infection, but are not the natural hosts.

The miracidia of *Schistosoma japonicum* are attracted to members of the genera *Oncomelania* and *Syncera*, but develop only in the former. *Paragonimus westermani* develops most frequently in the genus *Semisulcospira*; *Fasciolopsis buski* in *Hippeutis* and *Segmentina*; *Clonorchis sinensis* in several species of the subfamily Buliminae. The miracidia of the various trematodes die within a few hours if unable to penetrate a suitable snail host.

The length of time for cercarial development after the miracidium has penetrated the mollusk varies considerably according to ecologic conditions, but the following periods have been recorded: *Fasciola hepatica*, 32 to 54 days; *F. gigantica*, 39 days; *Paragonimus westermani*, 64 days; *Fasciolopsis buski*, 49 days; *Schistosoma japonicum*, 28 to 49 days.

Life histories, the morphology, experimental data, etc. of the trematodes are bibliographically listed in several of the current textbooks on helminthology or parasitology.

One of the unfortunate results of the study of trematodes and their molluscan intermediate hosts has been the numerous misidentifications that have crept into the literature. Malacologists have on occasion attempted to present trematode identifications without consulting the expert parasitologist, and likewise the trematode worker has published incorrect or obsolete molluscan names. In most cases of probable error there is no way to check the material. It would add materially to the standard of research if parasitologists would deposit a set of their experimental or expedition mollusks in a well established museum. In this way, future revisors will have available to them the specimens which were implicated as disease carriers. Attention is drawn to the section on "Techniques in Handling Schistosomiasis Snails".

TREMATODE DISEASES OF MAN AND THEIR MOLLUSCAN CARRIERS

SCHISTOSOMIASIS

Schistosoma japonicum Katsurada
- *Oncomelania quadrasi* Moellendorff
- *Oncomelania formosana* Pilsbry and Hirase
- *Oncomelania nosophora* Robson
- *Oncomelania nosophora slateri* Bartsch
- *Oncomelania hupensis* Gredler

CLONORCHIASIS

Clonorchis sinensis Cobbold
- *Parafossarulus manchouricus* Bourguignat
- *Alocinma longicornis* Benson
- *Bulimus fuchsianus* Moellendorff
- *Semisulcospira libertina* Gould. Implication doubtful.
- *Thiara (Plotiopsis) scabra* Müller. Implication doubtful.
- *Thiara (Tarebia) granifera* Lamarck. Implication doubtful.

PARAGONIMIASIS

Paragonimus westermani Kerbert
- *Semisulcospira libertina* Gould
- *Semisulcospira libertina extensa* von Martens
- *Hua amurensis* Gerstfeldt
- *Thiara (Tarebia) granifera* Lamarck
- *Oncomelania nosophora* Robson
- *Syncera lutea* A. Adams. Identification doubtful.

METAGONIMIASIS

Metagonimus yokagawai Katsurada
- *Semisulcospira libertina* Gould

FASCIOLOPSIASIS

Fasciolopsis buski Lankester
- *Segmentina (Polypylis) hemisphaerula* Benson
- *Hippeutis umbilicalis* Benson. Identification doubtful.
- *Hippeutis cantori* Benson

INCIDENTAL TREMATODIASIS

Fasciola hepatica Linnaeus and *gigantica* Cobbold
- *Lymnaea (Radix) auricularia* Linnaeus
- *Lymnaea (Radix) swinhoei* H. Adams
- *Lymnaea (Fossaria) ollula* Gould
- *Lymnaea (Pseudisidora) oahuensis* Souleyet [Hawaii][1]
- *Lymnaea (Pseudisidora) rubella* Lea [Hawaii][1]

Echinostoma ilocanum Garrison

Most Philippine fresh-water gastropods as first and second intermediate hosts. *Pila, Gyraulus, Viviparus, Lymnaea, Thiara, Oncomelania.*

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[1] Extra-territorial. Not discussed in this paper.

Echinostoma revolutum Frohlich
  Many Oriental fresh-water gastropods as first and second intermediate hosts. *Lymnaea, Bulimus, Segmentina, Viviparus, Corbicula, Sphaerium.*
Echinochasmus perfoliatus von Ratz
  Parafossarulus manchouricus Bourguignat
Heterophyes heterophyes von Siebold
  Pirenella conica Blainville [Mediterranean][1]
  Cerithidea cingulata microptera Kiener
Haplorchis pumilio Looss
  Semisulcospira libertina Gould
Haplorchis taichui Nishigori
  Thiara (Tarebia) granifera Lamarck
Diorchitrema formosanum Katsuta
  Semiculcospira libertina Gould
  Thiara (Tarebia) granifera Lamarck

SYSTEMATIC ACCOUNT OF THE MEDICALLY IMPORTANT GASTROPODA

Family AMNICOLIDAE (BITHYNIIDAE) or BULIMIDAE

These are small, aquatic gastropoda with a conical or subspherical shell which rarely exceeds a length of 10 mm. The sexes are separate, the males possessing an external copulatory organ, known as the verge, which is attached to the dorsal side of the neck and which is in the form of a single multi-pronged finger. The mantle edge is smooth. The tentacles are a little longer than the proboscis, round and thin. The foot is longer than broad, truncate in front and slightly pointed behind. The operculum is either corneous or calcareous, either paucispiral or concentric with a small paucispiral nucleus. The gills are low, plate-like and welded to the inner left-hand side of the mantle.

The name *Bithynia* Leach 1818, which has appeared in medical literature, is a synonym of *Bulimus* Scopoli 1777 and is therefore no longer in use.

The two most important subfamilies are the *Hydrobiinae*, members of which carry *Schistosoma japonicum* Katsurada, and the *Buliminae* which are the snail hosts of *Clonorchis sinensis* Cobbold.

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[1] **Extra-territorial. Not discussed in this paper.**

Subfamily HYDROBIINAE

The males have a single, curved fleshy verge or penis which is located on top of the body just behind the head (See fig. 1). The gills are from 75 to 100 in number, low, plate-like and attached to the left-hand side of the mantle as far to the right as the rectum which is also welded to the mantle. The operculum is thin, translucent, colorless and paucispiral. The radula is delicate, consisting of approximately 75 rows of teeth, each row containing 7 teeth.

Only the genus *Oncomelania* is responsible for the spread of schistosomiasis in the Orient. Other genera in the subfamily have not been implicated; they are *Tricula* (very small, less than 3 mm. in height), *Pachydrobiella, Pachydrobia, Jullienia, Lacunopsis* (last four rare, from Mekong River, Siam), *Fenouilia, Paraprososthenia, Delavaya, Hydrorissoia* and *Fairbankia.*

Genus ONCOMELANIA Gredler 1881

Oncomelania Gredler 1881, Jahrb. Deutsch. Malakoz. Ges., **8**, pp. 120–121, pl. 6, fig. 5 (Genotype: *O. hupensis* Gredler).

Hemibia Heude 1889, Journ. de Conchyl., **37**, p. 47, (Genotype: *O. hupensis* Gredler).

Katayama Robson 1915, Brit. Med. Journ., **1**, p. 203, figs. 7–9, 11 (Genotype: *K. nosophora*).

Schistosomophora Bartsch 1936, Smiths. Misc. Coll., **95**, no. 5, p. 29 (Genotype: *Prososthenia quadrasi* Moellendorff).

(See Appendix A: Generic Discussion of *Schistosomophora, Katayama* and *Oncomelania*).

The shells in this genus are slender and small, never exceeding a length of one-half inch. The outer lip of the aperture is strengthened by a varix or thickening of the rim. Most species are smooth, or with fine growth lines, but one species, *O. hupensis,* has either strong or almost obsolete axial ribs on the whorls.

The most characteristic feature for identification is the streak of yellowish, small color granules over each eye forming a false "eyebrow". The animal has a simple foot, the underside of which is truncate in front, where the fine mucus slit is located, and is rounded behind. Head relatively small; proboscis or snout blunt, slightly bilobed in front where the mouth is located. The single tentacle on each side of the head is slender, swollen at the base where the eye is situated. In male specimens, the verge or penis is located well behind the head on the dorsal side of the body and on the midline. It is far enough back to be obscured by the mantle. The verge is simple with a single, functional spermduct, is slightly flattened dorsally, rounded ventrally, and tapers gradually towards the rounded distal end. It is carried in a sinistral single-coil position. The mantle is thin with a slightly thickened border.

The gills or ctenidia consist of a series of 40 to 60 low, narrow lamellae or plate-like flesh folds which are attached to the inner left side of the mantle. The gills stretch across the mantle only as far as the rectum which is also welded to the mantle. The lamellae extend across the roof of the mantle for a short distance and then flatten out into indistinct filaments or para-ctenidial folds which are closely welded to the mantle.

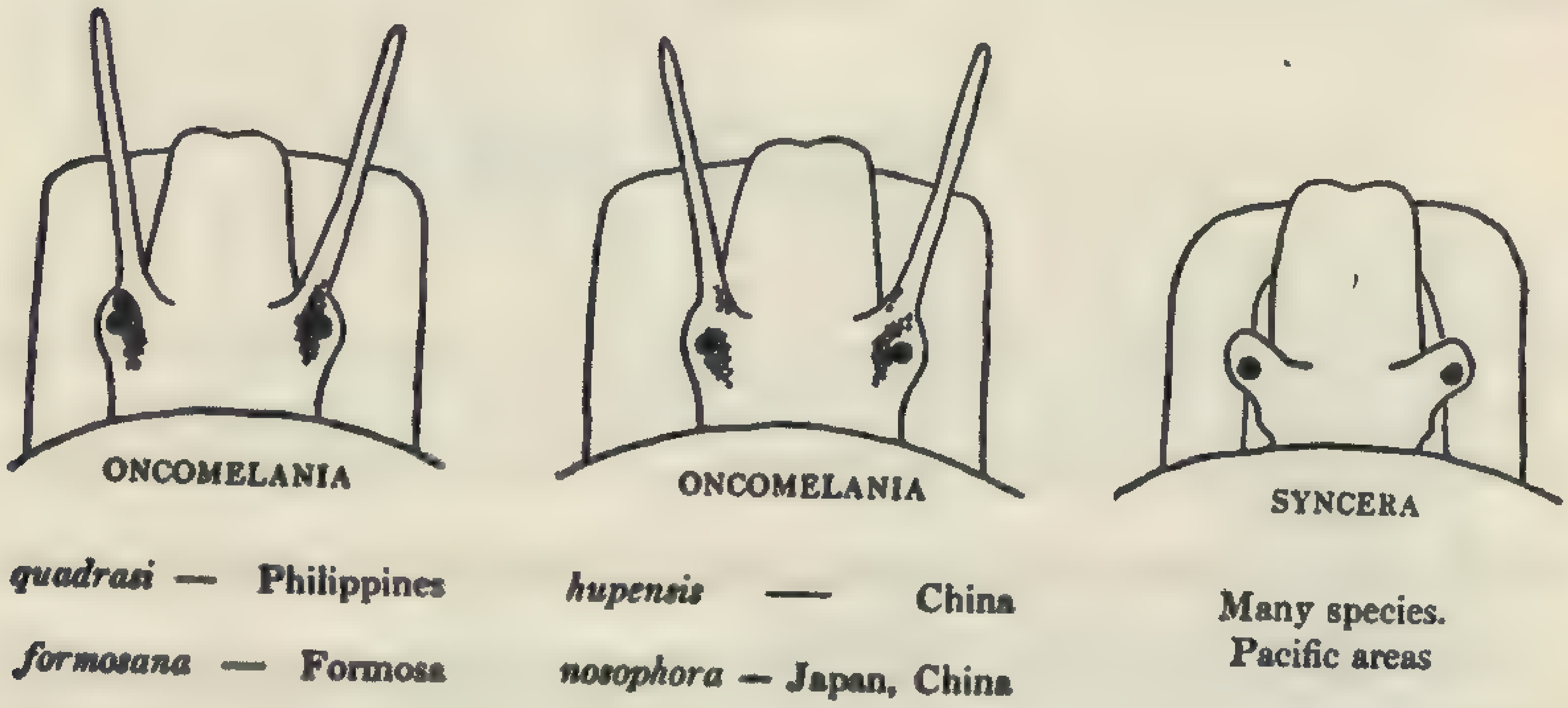

Fig. 5. Dorsal views of the head and forefoot of *Oncomelania* and *Syncera*. The spots over the eyes of *Oncomelania* represent yellow color granules.

The eggs of the members of this genus are laid singly or in short chains on waterlogged wood or porous stones. The eggs are small and are covered with an agglutinated sand jacket approximately 1.0 to 1.5 mm. in diameter. In one species, at least (*O. quadrasi Moellendorff*), the female utilizes its own soft fecal pellets which consist almost entirely of fine grains of sand. Though expertly camouflaged to match nearby lumps of mud or sand, the tiny capsule can be detected readily with the aid of a hand lens, because it has an artificial-looking, dome-like outline. Under adverse and aquarium conditions *Oncomelania* will sometimes lay eggs without adding a sand jacket. Egg laying in temperate climates appears to be most frequent in the spring and early summer. In the Philippines, it is year round, but most frequent during the rainy season. The young are ready to hatch in two weeks.

Oncomelania are amphibious and, though often found three or four inches under water, they are most frequently encountered along the moist earth and grass banks of creeks and canals, no farther than four feet from the water. A more detailed account of habitats is given under the various species.

The genera whose shells are likely to cause confusion with the *Oncomelania* in the Philippines and China are *Syncera* and young *Thiaridae.* In Japan, an additional genus, *Blanfordia,* can easily be mistaken for a schistosome carrier (See drawings and the family *Thiaridae*).

In examining dozens of genera and hundreds of species of Pacific and Asiatic fresh-water mollusks over a period of eight months in the field, it was found that all snails capable of carrying *Schistosoma japonicum* cercariae possess the following animal characters and that no other species of mollusks possess these characters:

"Animal with two slender gray tentacles with a color-streak or 'eyebrow' of bright yellow, closely-packed granules embedded in the skin just above the tiny black eyes."

Oncomelania:	Foot simple; tentacles present, eyes at their base; yellow streak or "eyebrow" of color granules above eyes; mantle edge smooth.
Blanfordia:	Anterior third of foot appears divided transversely from rest of foot when animal is out of water; tentacles present but very short; mantle edge smooth (Gills reduced or absent).
Syncera:	Short stubby eyestalks, with eyes buried near the ends; no gills.
Thiaridae:	Mantle edge serrated or smooth; tentacles present, with the eye at the base; in adults the inside of the mantle is tinged with blue green. In young, the nuclear and early whorls are ribbed. Tentacles with flecks of black, yellow or white. In some species there are pink dots on the underside of the foot.

ONCOMELANIA HUPENSIS Gredler

Plate 1, figs. 7–9

Oncomelania hupensis Gredler 1881, Jahrb. Deutsch. Malakoz., Ges. 8, pp. 120–121, pl. 6, fig. 5 (U-tschang-fu, Hupeh Province, China).

The adult shells are slender, from 7 to 10 mm. in length with 6 to 9 whorls. In areas of muddy canals, the shell is colored a gray brown; in clearer canals and creeks the color is waxy yellowish, amber to reddish amber. Nuclear whorls often tinged with rose. The numerous axial ribs on each whorl vary in number from 10 to 30 and are either stout and raised or low and almost obsolete. In adults only a strong varix or "over-developed rib" is present just behind the edge of the outer lip of the shell aperture.

The animal is as described under the genus above. The color of the "eyebrows" is light yellow; the color granules are fine, and the pattern is broken in some specimens with a small isolated grouping just anterior to the eye (See figures 1, *eb* and 5). The general color of the animal varies in individuals from the same locality from brownish black to a light yellowish brown. The verge of the male is lightly dusted with gray and has the tip colored rose.

This species is known only from the Yangtze River drainage system in China. It has been recorded from the following provinces: Kiangsu, Chekian, Anhwei, Kiangsi, and Hupeh. The following names have been applied to varieties or ecologic forms: *moellendorffi* Schmacker and Boettger 1890, *schmackeri* Moellendorff 1888, *sublevis* Heude 1890, *longiscata* Heude 1890, *carectorum* Heude 1890, *luteola* Heude 1890, *costulata* Heude 1890, *crassa* Heude 1890, *elongata* Bartsch 1936, *multicosta* Bartsch 1936, *yaoi* Bartsch 1939, *anhuinensis* F–C. Li 1936.

O. hupensis is found along the earth banks of canals. The snail is amphibious, preferring to remain out of water if the earth banks are moist and protected by grass or weeds. A certain number will be found just below the surface of the water at all seasons, but in the spring when the water rises and covers the snails, they prefer to remain at the water's edge or an inch above where they lay their eggs. In winter, they are sometimes clustered around the root stems of grass clumps, two to five feet from the water, but during moist and sunny days they become active. Mating has been observed in all months of the year, but egg-laying is limited commonly to spring and infrequently to summer. They may crawl into crevices in winter but have never been observed burrowing into the earth.

Canals which are near large lakes or whose waters rise and fall from the backing of ocean tides have a water's edge which is silty. In these places, and in main canals where boat traffic is heavy, the snails are absent for lack of protection and suitable firm surfaces on which to lay eggs. In many areas where the country is rocky and mixed with clay, such as around Nanking, the hard-packed canal banks are without protective vegetation and hence the snail is absent.

In rare instances, in areas where rice fields are only one or two feet above the canal level, *O. hupensis* have been found in appreciable numbers along the inside edge of the fields and in the moist, grassy ditches between the two. In the main, however, *O. hupenesis* is responsible for the disease being contracted in the canals.

The snails are not found on the muddy bottom of the canals where *Semisulcospira ningpoensis* Lea, *Alocinma longicornis* Benson, *Parafossarulus manchouricus* and *Stenothyra* are common. *Syncera* are occasionally found in company with *O. hupensis.*

We found that infection rates of this species 10 miles west of Shanghai ranged from 0.0% to 10.5%, a hundred specimens having been examined from each of 21 localities.

ONCOMELANIA NOSOPHORA Robson

Plate 1, figs. 1A, 2–4

Katayama nosophora Robson 1915, Brit. Med. Journ., 1, p. 203, figs. 7–9, 11 (Katayama, Japan).

The adult shells are slender, from 5 to 10 mm. in length, and with 6 to 9 whorls. The shell is smooth except for very fine axial lines of growth. The color in life is dark to light chestnut brown; sometimes the body whorl is tinged with red. The nuclear whorls are most often clear, though occasionally stained by a light tan. The length of the last whorl is equal to or less than that of the remaining whorls in the spire. When *O. hupensis* and *O. nosophora* occur in the same region, the latter species is on the average 1 to 2 mm. shorter in length. The varix behind the outer lip is either greatly or slightly thickened.

The animal is as described under the genus *Oncomelania.* The color of the "eyebrows" is light yellow, the granules fine and the pattern the same as in *hupensis.* The general color of the animal is a grayish black. The gills are frequently heavily dusted with minute black specks. The verge of the male is heavily dusted with gray and the tip has a very faint tinge of rose.

This species is found throughout the small valleys in the hilly regions of the southern two-thirds of China. It occurs from Szechuan and Yunnan in the West to Kiangsu and Kwantung Provinces in the East. It is well established in Japan on the islands of Honshu and Kyushu. Throughout these two countries, *nosophora* has a wide, spotty distribution, and many ecologic forms may be found. The colonies are generally very small in comparison with those of *hupensis*. Several of these colonies have been named by Bartsch under the

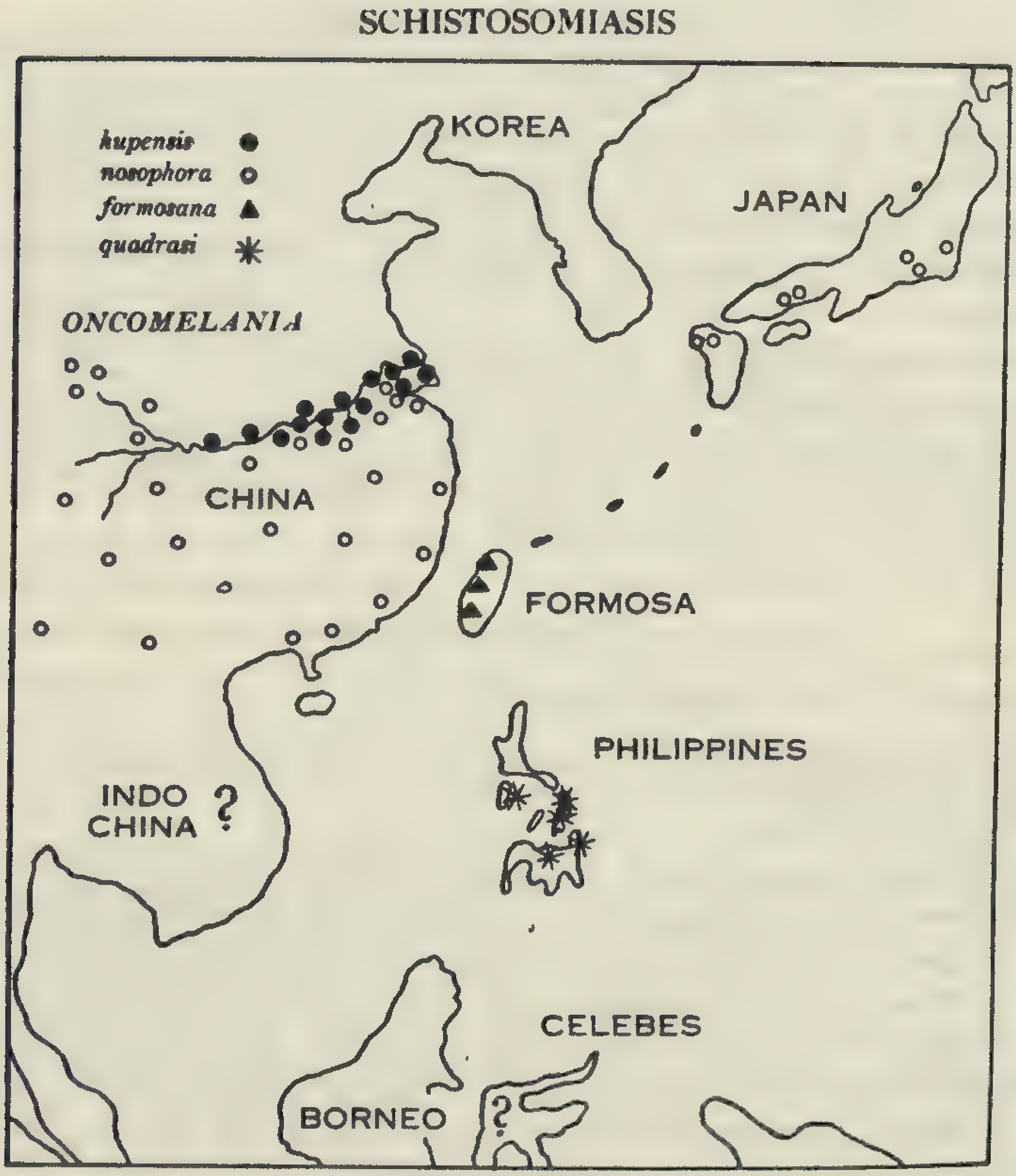
SCHISTOSOMIASIS
hupensis ●
nosophora ○
formosana ▲
quadrasi ✱
ONCOMELANIA
KOREA
JAPAN
CHINA
FORMOSA
PHILIPPINES
INDO CHINA ?
CELEBES
BORNEO
?

Fig. 6. The geographic distribution of the genus *Oncomelania*, the intermediate snail host of the Oriental Blood Fluke Disease. The snail hosts for this disease in the Celebes and Indo China are unknown.

names of *yoshida* 1925 (Kurume, Kyushu Island, Japan), *fausti* 1925 (Shao-Shing, Chekiang Province, China), *cantoni* 1925 (Fatshan, near Canton, China), *lii* 1936 (Lin-an and Hiau-Fen, Chekiang Province, China), *tangi* 1936 (Futsing, Fukien Province, China), *robertsoni* 1946 (Tali-Fu, Yunnan Province, China.) This last was described as a *Schistosomophora* in 1946 (Smithsonian Misc. Coll., **104**, no. 20, pp. 4–5, pl. 1, figs. 1, 7–10). The type of habitat in which this colony was found is typical of all *O. nosophora* in China and Japan.)

O. nosophora is not found in the canals of the Yangtze, but instead in small ditches and creeks in mountain valleys where nearby mountain brooks supply cool, clear water. In winter, these ditches usually lack their normal flow of water, but they remain moist. The snails are frequently found along the inner edges of the rice fields, especially when the small ditches are almost at the same level as the fields. For this reason, schistosomiasis is probably contracted in these hilly regions most frequently in the rice fields. The snails are not found in swift, rocky brooks or along the edges of large mountain rivers. Their amphibious tendency is as pronounced as that of *hupensis*.

Though individual specimens appear to be as heavily infected with schistosome cercariae, the percentage of infected snails has never been as great as that found in *hupensis* or *quadrasi*. Four different and unidentified cercarial infections, including a dual case, have been found in *nosophora* in Lin-an, Chekiang Province, China by the author. K. C. Chen (1941, Nat. Med. Jour. China, **27** (9), pp. 550–552) found cercariae of *Paragonimus westermani* in *O. nosophora* in Foochow, Fukien Province, China.

Some species of *Syncera* are commonly found in company with *O. nosophora*. However, there are many canals within ten miles of the ocean which support large colonies of *Syncera* but no *Oncomelania*.

ONCOMELANIA NOSOPHORA SLATERI Bartsch

Katayama species, Kuo, S. C., Yui, H. W., and Cheng, C. E. The Chinese Med. Jour., **63**, pp. 144–148, April, 1945.

Schistosomophora slateri Bartsch 1946, Smithsonian Misc. Coll., **104**, no. 20, pp. 5–6, pl. 1, figs 2–6 (P'aeng Hsien, Szechuan Province, China).

Adult shells 6 to 7 mm. in length, color a light chestnut brown, varix fairly well developed and whitish. The last whorl is always higher than half the height (length) of the entire shell. In this respect and in the texture and color of the shell, it is almost indistinguishable from most specimens of *O. formosana* and from an occasional specimen of *O. nosophora nosophora* from several localities in China and Japan. However, the constancy of the character of the large last whorl in 70 type specimens examined at the United States National Museum warrants the recognition of a good subspecies. The living animals have not been studied. This subspecies is known so far only from several areas near and west of Chengtu, including Chungchingchow, and Lei-Yang Sze and Shuang Lui, Szechuan Province, China, but other records are likely to be made on the periphery of the distribution of *O. nosophora* Robson. These specimens were collected by S. C. Kuo and Y. T. Yao in 1944 and were found to be very lightly infected with *Schistosoma japonicum.*

ONCOMELANIA FORMOSANA Pilsbry and Hirase

Blanfordia formosana Pilsbry and Hirase 1906, Proc. Acad. Nat. Sci., Philadelphia, **57**, pp. 750–751 (Rono, Formosa).

The study of the life cycle of *Schistosoma japonicum* was first completed in work with this species by Miyairi in 1913. It is intermediate in shell characters and geographic distribution between *O. quadrasi* Moellendorff in the Philippines and *O. nosophora* Robson in China. In shell character, it is closer to *nosophora*; in animal characters, closer to *quadrasi*. The adult shells are from 4 to 6 mm. in length with 6 to 7 whorls. The whorls are smooth and the last one is fairly large. The length of this last whorl is always greater than that of the remaining whorls in the spire. The varix just behind the outer edge of the lip is usually strongly developed. The color of the shell is a light chestnut brown. The nuclear whorls are clear.

The animal is as described under the genus *Oncomelania.* The general color of the animal is a grayish black. The "eyebrows" are bright yellow, compact and with coarse color granules as in *O. quadrasi* Moellendorff.

This species has been found at Rono; Kosyu, Kansai; Sintiku; on the Island of Formosa (Taiwan).

ONCOMELANIA QUADRASI Moellendorff

Plate 1, figs. 1b, 5–6

Prososthenia quadrasi Moellendorff 1895, Nachrichtsbl. Deutsch. Malakoz. Ges., **27**, p. 138 (Surigao Province, Mindanao Island, Philippines).

Oncomelania hydrobiopsis Rensch 1932, Philippine Journ. Sci., **49**, pp. 551–552, figs. 1 a–c (Palo, Leyte Island, Philippines).

The adult shell is from 3 to 5 mm. in length with 6 to 7 whorls. It is smooth, except for fine axial lines of growth. The varix is generally only slightly developed. The last whorl is always greater in length than the remaining whorls in the spire. The color of the shell in life is a translucent chocolate brown, but is sometimes covered with a thin black encrusting of mud-slime. The nuclear whorls are always clear.

The animal (Text fig. 1) is as described under the genus *Oncomelania*. The "eyebrows" (Text fig. 5) are bright yellow, compact and of coarse granules of color. The general color of the animal is a dark bluish gray or light grayish black, but sometimes with a light yellowish undertone.

This species is known only from the Philippine Islands. It occurs in the large valley at the northeastern fourth of Leyte Island. It has a spotty distribution over the entire island of Samar, except for the southern coast. On Mindoro it has been found in the region surrounding Lake Naujan on the east coast. In Mindanao, the snail is common in the northeast in the drainage system leading into Lake Mainit. Moellendorff gives "Surigao" as the type locality of this species. This apparently refers to the province of that name and not the town of Surigao which is on the north coast of the Surigao Peninsula. We made an intensive search for the snail around the town, but found that the unsuitable brackish water marshes extended inland for at least five miles. Its distribution is spotty in the north central regions, including Lake Lanao, and it has been reported in mountain valleys northeast of Davao.

Within the Leyte Valley, the schistosomiasis snail has a spotty, though widespread distribution. In general, it is limited to the many networks of winding, small creeks which feed into the larger streams and rivers. Its habitat may best be described as permanent, slow-running water which is under the influence of periodic flooding, and, hence, it is most frequently found on slightly sloping or flat land. The creeks are often modified into small, grassy marsh areas or into larger swamp areas with grass and trees. Wherever ditches alongside roads and rice fields are continuous with these creeks, conditions exist that are ideal for the snail (Habitat illustrations on plate 4).

The "ideal" habitat may be described as follows: A creek bed or adjoining area which remains moist in the severest dry periods; a creek or marsh which generally has a permanent, gentle flow of water. The banks must slope gently on both or one side. There must be refuge areas of moderately heavy shade from trees, bushes, or tall grass. The temperature must range between 75° and 85° F. The pH may vary from slightly acid to moderately alkaline. The notion that the snails prefer acid water is apparently in error. Like most fresh-water mollusks, *Oncomelania* is corroded in slightly acid water but thrives in slightly alkaline water where there is an ample source of calcium carbonate. Habitats that will not support this species of snail are: (1) The ocean, the intertidal zone and the tidal brackish zone. (2) Rivers, large streams, mountain brooks, and any fast flowing creek with steep banks. (3) Ponds, pools, marsh areas or ditches that are land-locked and fed solely by rainwater and, hence, not of a permanent nature. This includes carabao wallows unless they are in "ideal" creek beds. (4) Quiet, shady and shallow bodies of water along the sides of a large river, which appear in low-water periods to be ideal, but which during rainy spells are flooded by swift currents and disturbed by a shifting bottom. (5) Any body of fresh-water with excess pollution from man-made dumps.

The snail's preference concerning its immediate surroundings tends towards dead leaves, coconut husks, sticks which are moist or submerged in a few inches of water. In low-water periods, the snails are frequently found on the surface of wet mud and coconut husks; when the water level falls slowly, the snails are found at the juncture of the surface of the water with the substratum. During high water, when there is a current, the snails remain attached to grass stems well under the surface and make no hurried vertical progress. After a slow, gentle, all-night rain, the snails may occasionally be found as high as two or three feet out of the water on the grass stems. The snail shows no pronounced phototropism, although it is found most frequently in shady spots. It is negatively geotropic when the surface above it is humid or moist. In the laboratory and occasionally in the field when the snail finds itself on a dry surface, it will withdraw into its shell. The withdrawal and folding of the foot squeezes out a surplus of mucus from the anterior pedal gland which seals the operculum and glues the body whorl to the surface on which the snail has been crawling. This attachment is very weak, and gentle tapping or even the force of a single raindrop will dislodge the snail.

The inability of *Oncomelania* to extricate itself from silty mud is probably one of the main reasons why they are unable to exist in rivers and steep-banked streams where the sand and mud are continually shifting.

A specialized mode of dispersal of these snails from one area to another is suggested by the frequent travels of carabao covered with mud in which the snails might be present.

Measurements of many snails of this species showed that the average male was 1 mm. shorter than the female (4 and 5 mm., respectively). This was found to be true if a random sample was taken in a small restricted area where the colony had not been disturbed.

Other mollusks found in company with *Oncomelania quadrasi* Moellendorff are *Thiara tuberculata* Müller (common), *Viviparus* (common), *Pila* (common), *Lymnaea* (*Fossaria*) (uncommon), *Physastra* (uncommon), and *Myxas* (family *Lymnaeidae*) (rare). Mollusks not found in company with this species are *Neritina, Brotia, Thiara scabra* Müller, *Syncera* and several species of *Stenomelania.* In areas where warm, sluggish ponds and pools exist, *Viviparus, Lymnaea, Gyraulus,* and *Myxas* are sometimes common, but *Oncomelania quadrasi* are absent.

The food of the snail has not been definitely identified. Fecal pellets show much grit from mud mixed with desmids and cells of higher plants. The snail is not attracted to dead fish as is the case with *Syncera,* nor will it eat live hydra attached to the underside of the leaves. The snail apparently does not seek out food, but merely browses wherever its preference for shade or ideal water conditions may take it.

On Samar the snail has a wide distribution in the western, northern and central regions. Unlike the Leyte form, it is found close to mountains in very small valleys and narrow coastal plains. Colonies of this form are exceedingly limited in size and are often on an area of sloping ground no larger than a tennis court. Nowhere is there found the long, continuous creek distribution that is typical of the Leyte colonies. In one instance on Samar, the snails were found on slopes of 30° and were completely isolated from any other suitable breeding grounds. The contrast between the two island habitats might be likened to the difference between *Oncomelania hupensis* in China (Leyte-like in habitat) and the *Oncomelania nosophora* of Japan and China (Samar-like).

We are giving here all the known locality records for *O. quadrasi.*

Leyte Island. The snails are limited to the Leyte Valley at the northeast fourth of the island. The area is approximately 25,000 square miles and the most westerly localities are from Alangalang south through Pastrana, Dagami, Burauen, La Paz to Tarragona (8 miles north of Abuyog). The most easterly records occur along the coast from Palo south to Tarragona. The snail has not been found after intensive search in Tacloban, Abuyog, Carigara, Ormoc, or Baybay or in any mountain streams, ponds or lakes.

Samar Island. Calbiga; Sitio Nadang, 2.1 miles northeast of Oquendo on Route No. 1; western outskirts of Gandara; a half mile north of San Miguel, 2 miles south of Gandara on Route No. 1; east side of Cabulaloan Valley, 3 miles west of Bayog, 8 miles up the Catubig River; Barrio of Malijao, 10 miles south of Catarman; Sitio Dagganas, 2 miles west of Catarman. No records for the entire southern coast.

Mindanao Island. Kilometer post no. 42, between Tubod and Alegria, Lake Mainit drainage; 1 mile northeast of Mainit, near road, Lake Mainit drainage; ditch running from road to Lake Lanao, 2 miles southeast of Danaslan City; Linabo, 40 miles southeast of Cagayan (W. H. Wright); Calasig Barrio, 1.5 miles east of Lala, Calanbugan Valley, southeast of Cagayan (W. H. Wright); Jabonga, Agusan Province (Tubangui). No records after search in the Davao and Zamboanga areas.

Mindoro Island. In the creeks leading to Lake Naujan (Tubangui); Badoc Creek, Sitio Borbuculan; Tributary of Pola River, Pola Municip; Sitio Malabo, Naujan Municip (last three by G. W. Hunter, 3rd).

There are three important areas from which *Oncomelania* have not been recorded — the Lake Lindoe area in the central part of Celebes Island, Indo-China and the Northern Shan States in Burma. Schistosomiasis has been thought to be present in the first two localities mentioned. At Kutkai, northern Burma, a small shell has been collected and named *Tricula martini* Rao 1928, (Rec. Indian Mus., **30**, pp. 434-436, figs. 9 and 10) which is probably an *Oncomelania*. The figures of the shell are quite close to *O. quadrasi* Moellendorff. It was found "in a small channel flowing into the Nam Teng river end which was choked with lilies, grass and other weeds. A few were also found at the edge of Nam Khai stream." Rao says "the animal is of a chocolate brown color, and has short tapering tentacles and a moderately long proboscis which extends beyond the foot when the animal creeps forward. There is a black eyespot at the outer base of each tentacle with a lunate yellow mark on the inner half. The foot is short, broad, blunt at the lateral angles, and broadly rounded behind. The radula formula is 2.1.1.1.2. The central tooth (rachidian) has three cusps on its upper margin, the median one being larger and sharper. On the anterior face of the tooth there is usually a single pointed denticle at the base on each side, but a very minute second denticle can be seen in good light. The lateral has several teeth of which the third from the inside is much enlarged, conical and pointed. The marginals have fewer teeth."

"Height of shell, 4 mm.; breadth, 2.0 mm.; height of aperture, 1.5; breadth of aperture, 1.0 mm."

Genus BLANFORDIA A. Adams 1863

Blanfordia A. Adams 1863, Ann. Mag. Nat. Hist., ser. 3, **12**, p. 424 (Genotype: *Tomichia bensoni* A. Adams)

Members of this genus are restricted to the Japanese Islands and have never been implicated as intermediate hosts of trematodes infecting man. References in medical literature to "*Blanfordia*" as carriers of schistosomiasis are erroneous. Since only preserved material has been available for study, no attempt has been made to differentiate the known species on the basis of animal characters. A list of the known *Blanfordia*, all from Japan, is appended below. A full list of synonyms and descriptions of shell characters is given by Bartsch 1936, Smiths. Coll., **95**, No. 5 (Publication 3384). If this genus has the same type of speciation as that found in the genus *Syncera*, it is very likely that all of the species listed below will prove to be good. Until notes are made on the living animals, their color patterns and verges, there will remain confusion in this genus.

The shell is small, ovate, being much more globose than *Oncomelania*, and smooth; the smallest species averages 3 mm. and the largest 8 mm. in length. The varix on the outside of the lip is very similar to that found in the *Oncomelania*. Operculum thin, transparent, paucispiral. In most specimens the apex of the shell is worn away. The nuclear whorls, when present, are clear and the same as in *Oncomelania* (See plate 1, fig. 10).

The tentacles are very short and taper rapidly to a point. The operculum is set on a fleshy lobe of the posterior foot, much more prominent and more drawn out posteriorly than the lobe of *Oncomelania*. Gills are either absent or very much reduced. The verge is simple with a swelling near the end (See text fig. 11).

For many years *Blanfordia* has been grouped with the American genus *Pomatiopsis* in the family *Pomatiopsidae* (Gill, Pilsbry, Annandale, etc.). The author has made a critical anatomical examination of living *Pomatiopsis lapidaria* Say from United States and finds that it is most closely related to the genus *Oncomelania* Gredler (forthcoming report). The "divided foot" in *Pomatiopsis*, as Pilsbry has pointed out, is merely a folding in the flesh which is not evident when the snail is examined under water.[1] The gills, verge, radula, shell and operculum of *Pomatiopsis* are typical of the subfamily *Hydrobiinae.* In the author's opinion, the family *Pomatiopsidae* should be submerged in the family *Amnicolidae* as a synonym of the subfamily *Hydrobiinae.*

Species of *Blanfordia*

Blanfordia integra Pilsbry. Izumo, Honshu.

Blanfordia (*Vicina*) *integra* Pilsbry 1924, Proc. Acad. Nat. Sci. Philadelphia, **76**, p. 12, fig. 3.

Blanfordia japonica A. Adams. Sado Island. Plate 1, fig. 10.

Tomichia japonica A. Adams 1861, Ann. Mag. Nat. Hist., ser. 3, **8**, p. 308; **12**, p. 424, pl. 7, fig. 12.

Blanfordia bensoni A. Adams. Ojima, Hokkaido.

Tomichia Bensoni A. Adams 1861, Ann. Mag. Nat. Hist., ser. 3, **8**, p. 308; **12**, p. 424, pl. 7, fig. 11.

Blanfordia simplex Pilsbry. Noto; Uzen, Honshu.

Blanfordia japonica var. *simplex* Pilsbry 1902, Proc. Acad. Nat. Sci Philadelphia, **54**, pp. 26–27.

Subfamily BULIMINAE

In this group of genera are found the majority of the first intermediate hosts of the human bile fluke, *Clonorchis sinensis* Cobbold. There are three features which aid in determining whether or not the snails at hand belong in this group (See text fig. 7). (1) The operculum is thick and calcareous, usually concentric with a small subcentral, spiral nucleus. The operculum in adults cannot be withdrawn into the shell aperture. (2) In males, the external penis, located on the dorsal side of the neck inside the mantle cavity, is a curved, fleshy prong with a long finger-like appendage arising from the inner, concave central part. (The *Hydrobiinae* are without this lateral appendage.) (3) There is a small, cup-shaped skin-flap attached to the right side of the head just behind the right tentacle.

The animals are usually whitish gray or dark slate gray with tiny color dots of orange or yellow over the body. The genus *Viviparus,* the pond snails, also has these color dots, but can be separated from the *Buliminae* by the absence of the verge on the neck of the males, and by the presence of a horny, pliable, brown operculum. *Viviparus* often grow to a length of two inches, while members of the subfamily *Buliminae* rarely exceed a length of three fourths of an inch.

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[1] After this paper went to press, examinations were made of living *Blanfordia.* The foot is simple as in *Oncomelania* and *Pomatiopsis.*

SUBFAMILY BULIMINAE

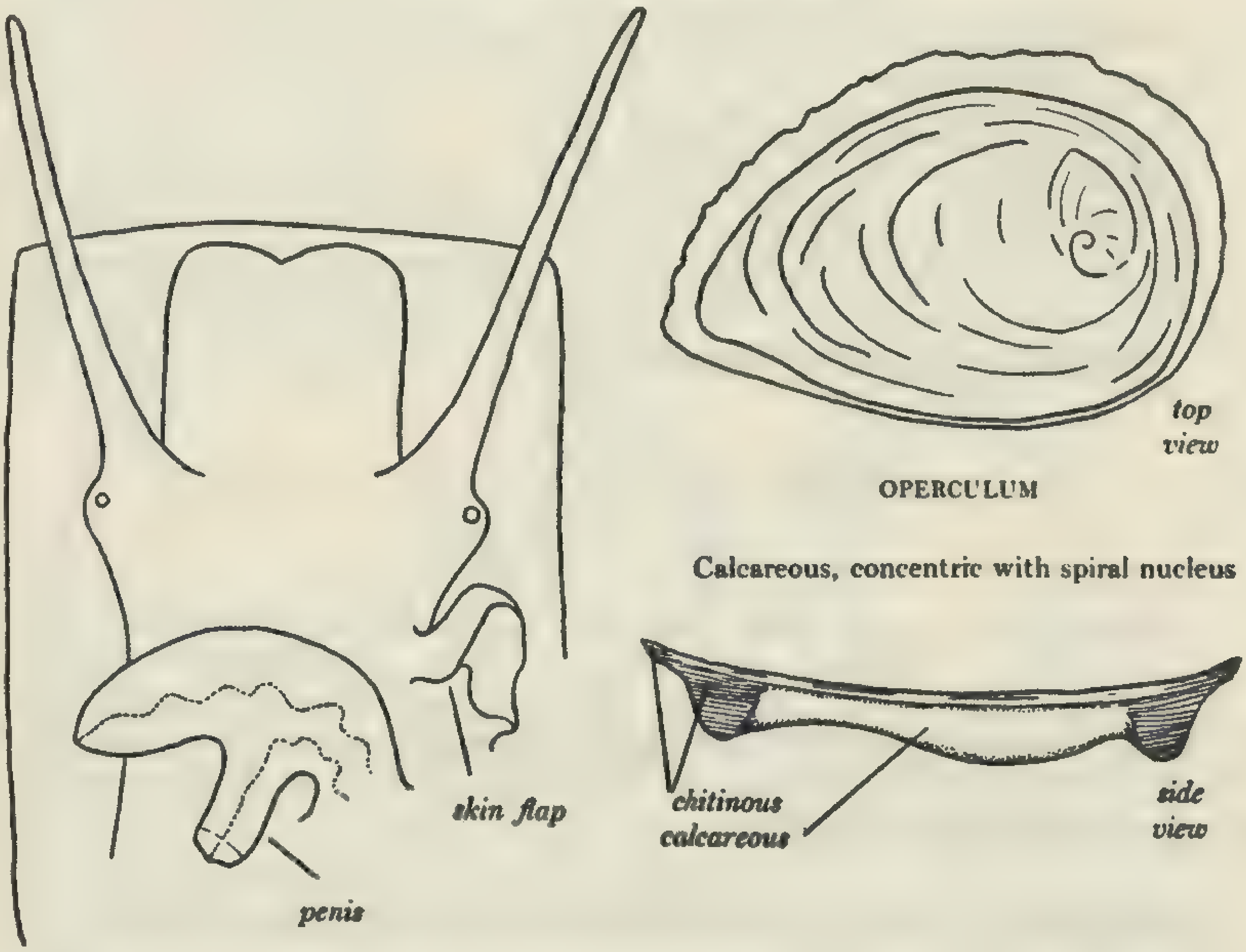

top view
OPERCULUM
Calcareous, concentric with spiral nucleus
skin flap
chitinous
calcareous
side view
penis

Fig. 7. Dorsal view of head and verge of the *Buliminae* animal, and views of the operculum.

The following genera of *Buliminae* are found in the Orient:

Parafossarulus:	Shell with raised spiral lines, ridges or keels. Lip of aperture thickened.
Alocinma:	Shell smooth, subglobular, with a glassy transparency.
Bulimus:	Shell fragile; whorls well rounded, smooth except for axial lines of growth. Lip not thickened.
Digoniostoma:	Shell like *Bulimus* but with prominent umbilicus which has a ridge or carina on its edge at the base of the shell.

Wattebledia: Shell like *Bulimus* but the edge of the lip is sinuate or wavy. One species in southern China.

Hydrobioides: Shell like *Alocinma* but the inside and outside of the lip has a thickening or strong varix. Rare, known from India, Siam and Cambodia. Not discussed in this paper.

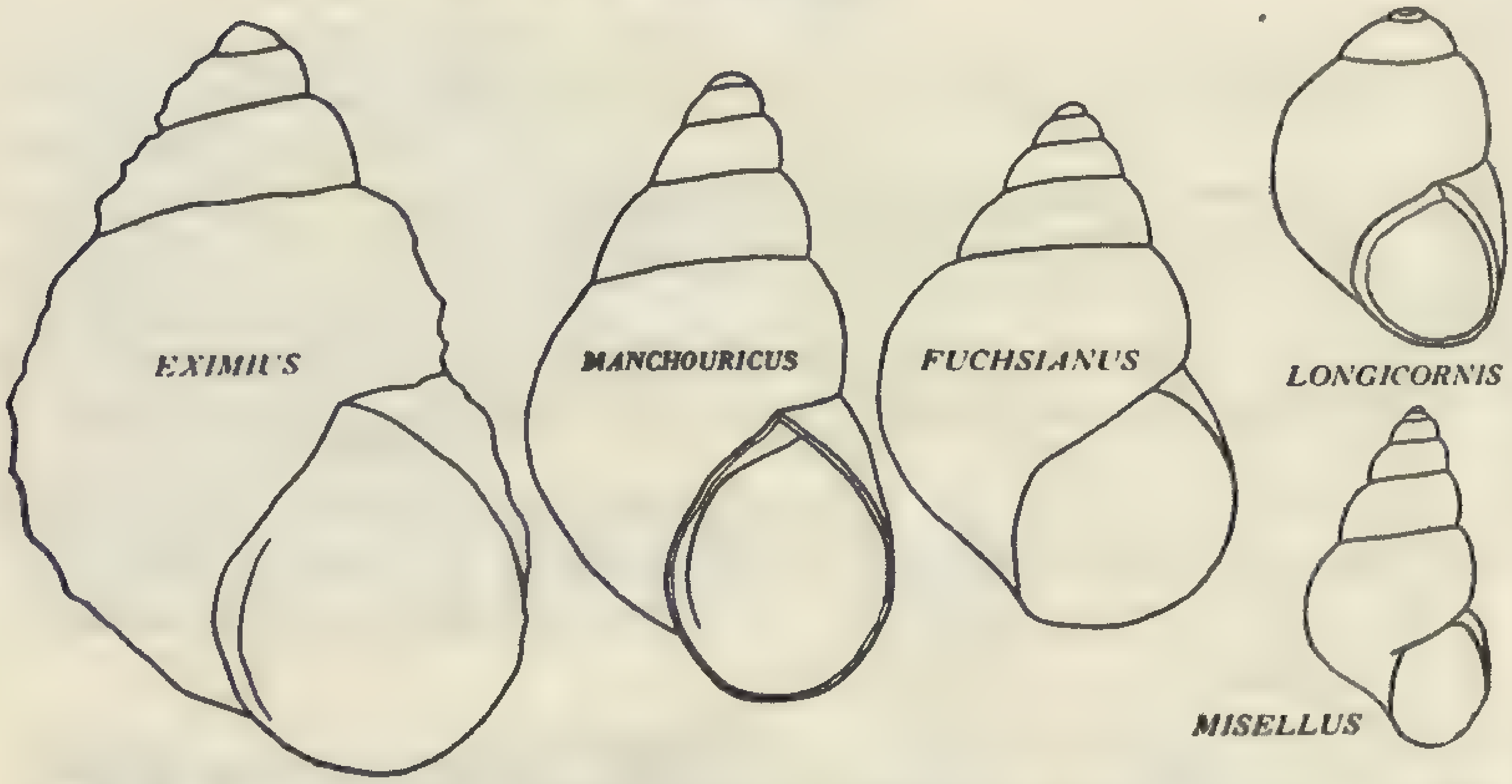


Fig. 8. Proportionate outline drawings of several Chinese species of *Buliminae*. *Parafossarulus eximius*, *P. manchouricus*, *Bulimus fuchsianus*, *B. misellus* and *Alocinma longicornis* (x 4).

For workers in China, the following review of animal characters will be of use in identifying the four most common species found in the canals and lakes.

Parafossarulus manchouricus	*Alocinma longicornis*	*Bulimus fuchsianus*	*Bulimus misellus*
Underside of foot with orange spots	Underside of foot without color spots		
In life, top whorls pinkish tan		In life, top whorls black	
	Color spots on body yellowish	Color spots on body reddish	
		Mantle black with small, clear spots	Mantle clear with black cobwebby mottlings

Genus PARAFOSSARULUS Annandale and Prashad 1924

Parafossarulus Annandale and Prashad 1924, Proc. Malac. Soc. London, **16**, p. 28 (as a subgenus of *Hydrobioides*). (Genotype: *Paludina* (*Bithynia*) *striatula* Benson = *P. manchouricus* Bourg.

There are three recognized species in this genus, all from China, but only one, *P. manchouricus*, is known to be an intermediate host of the bile fluke, *Clonorchis sinensis*. Members of this genus range in length from about 7 to 17 mm. The shell has weak or strong raised, spiral threads or keels. The lip of the aperture is thickened at the rim; but no large swelling in the form of a varix appears just behind the reflexed rim. The operculum is hard, thick and calcareous with a small spiral nucleus in the center of a series of uneven, concentric circles.

PARAFOSSARULUS MANCHOURICUS Bourguignat

Plate 1, fig. 17

Paludina (*Bithynia*) *striatula* Benson 1842, Ann. Mag. Nat. Hist., **9**, p. 488. (Chusan Island, China). Non *striatula* Deshayes 1825.

Bythinia striata "Benson" Gerstfeldt 1859, Mem. Divers Sav. Acad. Sci. St. Petersburg, **9**, p. 511, species 2, pl. 1, figs. 11a-b. (Amur River; Ussuri-River). Lapsus.

Bythinia manchourica "Gerstfeldt" Bourguignat 1860, Rev. Mag. Zool., (2), **12**, p. 535, pl. 24, figs. 11–13. (Amur River).

Bithinia striata Gerstfeldt, von Schrenck 1867, Reis. u. Forschungen im Amur-Lande, Acad. Wiss. St. Petersbourg, **2**, p. 24.

Bithynia striatula var. *japonica* Pilsbry 1901, Proc. Acad. Nat. Sci., Phila., p, 405. (Manabe, Hidachi and Osaka, Japan); ibid, 1902, p 121, pl. 9, figs. 9-11

Bythinia zeni Ping and Yen 1932, Bull. Fan Mem. Inst. Biol., **3**, (2), p. 33, figs. 12–14. (Peiping, China).

This species is the main carrier of *Clonorchis sinensis* in Japan and is the second most important intermediate host in China. It has also been implicated as the first intermediate host of *Echinochasmus perfoliatus* von Ratz. As is the case with widely distributed and variable fresh-water species, it has been known under several names, the most commonly used having been *P. striatulus* Benson. However, *manchouricus* is now considered the earliest correct name.

Adult shells vary in length from about 7 to 10 mm. The shell is ovate-conic in shape, with spiral raised lines or ridges of varying number and strength on the whorls. The lip is usually thickened and sometimes colored dark brown. Color of shell varies from yellowish brown, horn color to greenish horn. The operculum, which cannot be withdrawn into the aperture of the shell, is calcareous, concentric, with a small, subcentral, spiral nucleus.

The animal has a simple foot, bluntly truncate in front and slightly tapering posteriorly. The proboscis is notched in front. The tentacles are fairly slender, round with swellings at their base where the small black eyes are located. There is a small cup-shaped skin-flap on the side of the neck just behind the right tentacle. The mantle is transparent whitish with gray-black mottlings of varying pattern and density.

The color of the animal is a slate gray over which are many spots of bright cream orange. The proboscis is a dark slate gray with its tip colorless. The tentacles have an internal black "core" of color with heavy, elongate orange color granules embedded in the transparent flesh encircling the black "core." The underside of the foot is spotted with orange dots. The upper whorls in life appear a light pinkish tan.

The verge is in the center of the dorsal side of the neck. It is a flesh prong curving to the left with a smaller finger-like appendage arising from its concave central part. The gray dusting on the penis varies greatly in density among individuals.

This species is found throughout most parts of China, although it is most abundant in the Central and Northern sections. It is common in the lakes, ditches and canals of Formosa and Japan. Faust reports that it is not found in the fish ponds in the Canton, China, area. This species is collected most easily with a dip net where weeds and grass offer protection. Dead shells along the banks of canals usually indicate the nearby presence of large colonies of living *P. manchouricus.*

PARAFOSSARULUS SINENSIS Neumayr

Plate 1, fig. 18

Fossarulus sinensis Neumayr 1887, Erdgeschichte, **2**, p. 536, fig. 1.
Fossarulus sinensis "Neumayr" Moellendorff 1888, Malak. Blätter, N. F., 10, p. 136, pl. 4, figs. 3a-b (first described). (Yangtze, near Hankow).

This may possibly be a variety of *manchouricus* which in certain localities develops strong spiral ribs and a well reflected outer lip. Adults vary from 9 to 10 mm. in length. It is found occasionally in small bodies of clear water throughout the Yangtze River drainage. It has not been known to carry *Clonorchis*, but may be looked upon with suspicion.

PARAFOSSARULUS EXIMIUS Frauenfeld

Plate 1, fig. 15

Vivipara eximia Frauenfeld 1864, Verh. Zool. Bot. Ges. Wien, **14**, p. 149, pl. 5, fig. 2 (Northern China); ibid, pp. 586, 604.

Bithynia subangulata von Martens 1875, Jahr. Deut. Mal. Ges., **2**, p. 133, pl. 3, fig. 4.

Bithynia grandis Moellendorff 1888, Mal. Blätter N. F., **10**, p. 132, pl. 4, figs. 1a-b.

Pseudovivipara hypocrites Annandale 1918, Mem. Asia. Soc. Bengal, **6**, p. 310, pl. 10, fig. 3-3a (Tong Dong Ding, Tai-hu, Kiangsu Province, China).

Pseudovivipara subangulata von Martens, A. Zilch, 1938, Arch. für Moll., **70**, pp. 128–131, figs. 1–4.

This is the largest Chinese bulimoid species which sometimes reaches a length of 17 mm. At first glance, it looks like a small *Viviparus*, but the calcareous operculum at once places it in the subfamily *Buliminae*. The shell is heavy, usually reddish brown in color, with 3 or 4 spiral, strong ribs on the whorls, although some specimens are almost smooth. In nearly every instance the spire of the shell has been corroded in nature. It lives on sand-mud bottoms, rocks and stems or reeds along the shores of lakes and ponds. This species is distributed throughout eastern and central China, and has not been implicated as a carrier of *Clonorchis*.

The color of the animal is dark gray with numerous small golden dots over the entire body. The verge, radula and internal anatomy have been recently studied in fresh material and found to be typical of *Parafossarulus*.

Genus ALOCINMA Annandale and Prashad 1919

Alocinma Annandale and Prashad 1919, Rec. Indian Mus., **18**, p. 23, (Genotype: *Amnicola sistanica* Annandale and Prashad; India).

Shell solid, subglobular, without an umbilicus, of a glassy transparency, smooth. The operculum and verge as in *Parafossarulus*. There are about eight species in this genus, all fairly small (adults less than 5 mm. in length), and all are from India, Ceylon and Siam except for one large Chinese species, *A. longicornis* Benson, which occasionally serves as a first intermediate host of *Clonorchis sinensis* Cobbold.

ALOCINMA LONGICORNIS Benson

Plate 1, fig. 20

Paludina (*Bithynia*) *longicornis* Benson 1842, Ann. Mag. Nat. Hist., **9**, p. 488 (Chusan Island, China).

Stenothyra tonkiniana Morlet 1886, Diagn. Moll. Terr. Fluv. Tonkin, p. 5; 1886, Journ. de Conchyl., **34**, p. 287, pl. 14, figs. 4, 4a-b (Dong-song, Tonkin).

This species is known to be one, but apparently not the main, first intermediate host of *Clonorchis sinensis* in China. It has a wide distribution, and is commonly found in canals and ponds in eastern, central, and southeastern China. This shell is smaller than most species of *Parafossarulus,* having a length of 5 to 8 mm. Adults are solid, subglobular, smooth, without an umbilicus, with a short spire and bluntly rounded apex.

The animal may be distinguished readily from *Parafossarulus manchouricus* by the absence of cream orange dots on the underside of the foot. The animal is a light slate gray, dotted with greenish yellow color granules which sometimes tend towards bright yellow anteriorly. The tentacles are translucent with a fine, black "core" and are sparsely flecked with thin, elongate orange-yellow bars which are embedded in the flesh. The mantle is black with chalk-white, large irregular blotches.

Genus BULIMUS Scopoli 1777

Bulimus Scopoli 1777, Intro. ad Hist. Nat., p. 392 (Genotype: *Helix tentaculata* Linnaeus.

Bithynia Leach 1818 in Abel's "Narrative of Journey to Interior China," p. 362 (Genotype: *Helix tentaculata* Linnaeus).

Bulimus Scopoli 1777 = *Bithynia* Leach 1818 by reason of opinion 116 rendered by the International Commission on Zoological Nomenclature, 1931.

The genus *Bulimus* has gone under the names of *Bithynia, Bithinia* and *Bythinia,* and many species once assigned to this genus have now been removed to the genera *Parafossarulus, Alocinma* and *Digoniostoma.* True *Bulimus* is represented in China by several species, the two most frequently found being *B. misellus* Gredler and *B. fuchsianus* Moellendorff. The latter only has been known as the chief first intermediate host of *Clonorchis sinensis* Cobbold in China. There are two or three small-sized *Bulimus* in the Philippines and the East Indies, none of which have been known to be carriers.

BULIMUS FUCHSIANUS Moellendorff

Plate 1, fig. 19

Bythinia fuchsiana Moellendorff 1888, Mal. Blätter, N. F., **10**, p. 134, pl. 4, figs. 2, 2a-b (Hunan, southern part).

Bithynia critica Gredler 1889, Nachtrbl. D. Mal. Ges., **21**, p. 160 (Hensan, Hunan Province, China).

Bithynia delavayana Heude 1890, Mém. Hist. Nat. Emp. Chinois, **1**, pt. 4, p. 170, pl. 42, fig. 5 (Lam-kong, Yunnan, China).

Bithynia toucheana Heude 1890, Mém. Hist. Nat. Emp. Chinois, **1**, pt. 4, p. 171, pl. 42, figs. 6-6a (Fou-tcheou, Fukien, China).

This is the main first intermediate host of *Clonorchis sinensis* Cobbold in southern China. It is also commonly found throughout eastern, western and central China. Adult shells are about 10 mm. in length; the shell is fairly fragile in comparison with *Parafossarulus* species. There are hardly any signs of spiral sculpturing, but often there are one or two raised axial lines on the whorls indicating where a former, earlier lip had formed. The whorls are well rounded. The lip of the shell is never thickened to any great extent and it is easily broken. Color of shell usually a dull, translucent greenish brown. The operculum is calcareous, concentric with a subcentral, spiral nucleus.

The animal is colored a slate gray with numerous, small brilliant orange-red spots on the body, foot and tentacles. Inside the tentacles may be seen a round, black "core" of color. In life, the upper whorls of the spire appear to be blackish. The mantle is black with numerous small, translucent cream spots unevenly distributed over it.

The details in mantle pattern vary in individuals of both species, but the general type of pattern remains constant for each species; in *fuchsianus* the mantle is black with small round spots of translucent cream; in *misellus* the mantle is translucent with sparse, black, cobwebby mottlings.

BULIMUS MISELLUS Gredler

Plate 1, fig. 16

Bythinia misella Gredler 1884, Arch. f. Naturg., **50**, pt. 2, p. 276, pl. 19, fig. 8 (Changninghsien, Hunan).

Bythinia viridescens "Moellendorff" Heude 1890, Mém. Hist. Nat. Emp. Chinois, **1**, pt. 4, p. 170, pl. 42, fig. 1 (Tcheu-keou, China).

This small species (adults 5 to 7 mm. in length) is not uncommon in canals and ponds throughout China, Japan and Formosa. It has not been implicated as a disease carrier, but this may be due to its relative scarcity. This species is distinguished from others in the genus by its well rounded whorls. deeply indented suture, small size, and mantle color pattern. A large specimen of *misellus* (7 mm. in length) has 5½ whorls, while young specimens of *Parafossarulus manchouricus* of the same length have only 3½ whorls

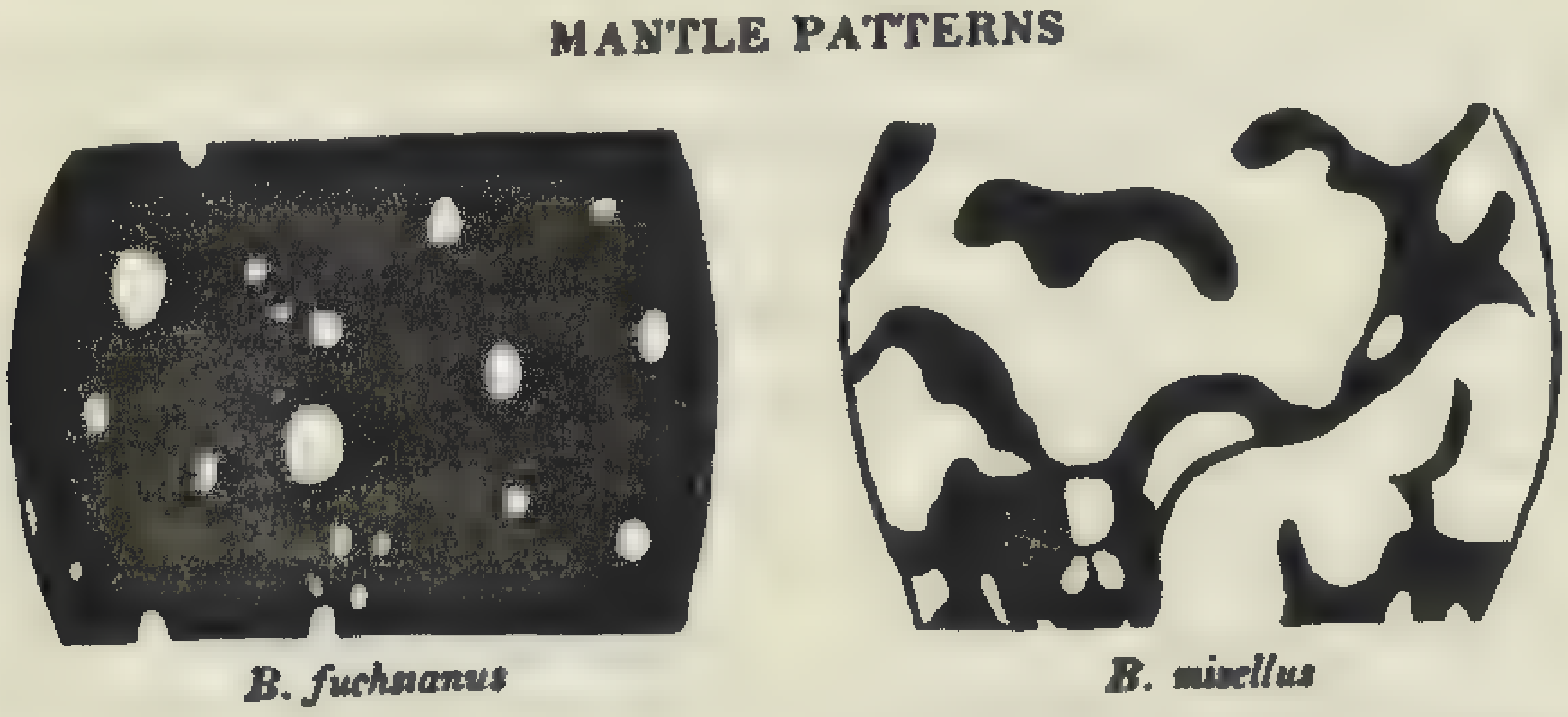


Fig. 9. Mantle patterns in *Bulimus fuchsianus* and *B. misellus*.

Genus DIGONIOSTOMA Annandale 1920

Digoniostoma Annandale 1920, Indian Journ. Med. Res., **8**, No. 1, pp. 103–104 (Genotype: *Bithinia cerameopoma* Benson. India).

This genus is very closely related to *Bulimus*, differing only by the presence of a slightly raised carina which borders the interior of the narrow umbilicus. Adult *Digoniostoma* are about the size of the other genera in the *Buliminae*, ranging in length from 6 to 10 mm. No members of this genus are known to be carriers of human trematodes.

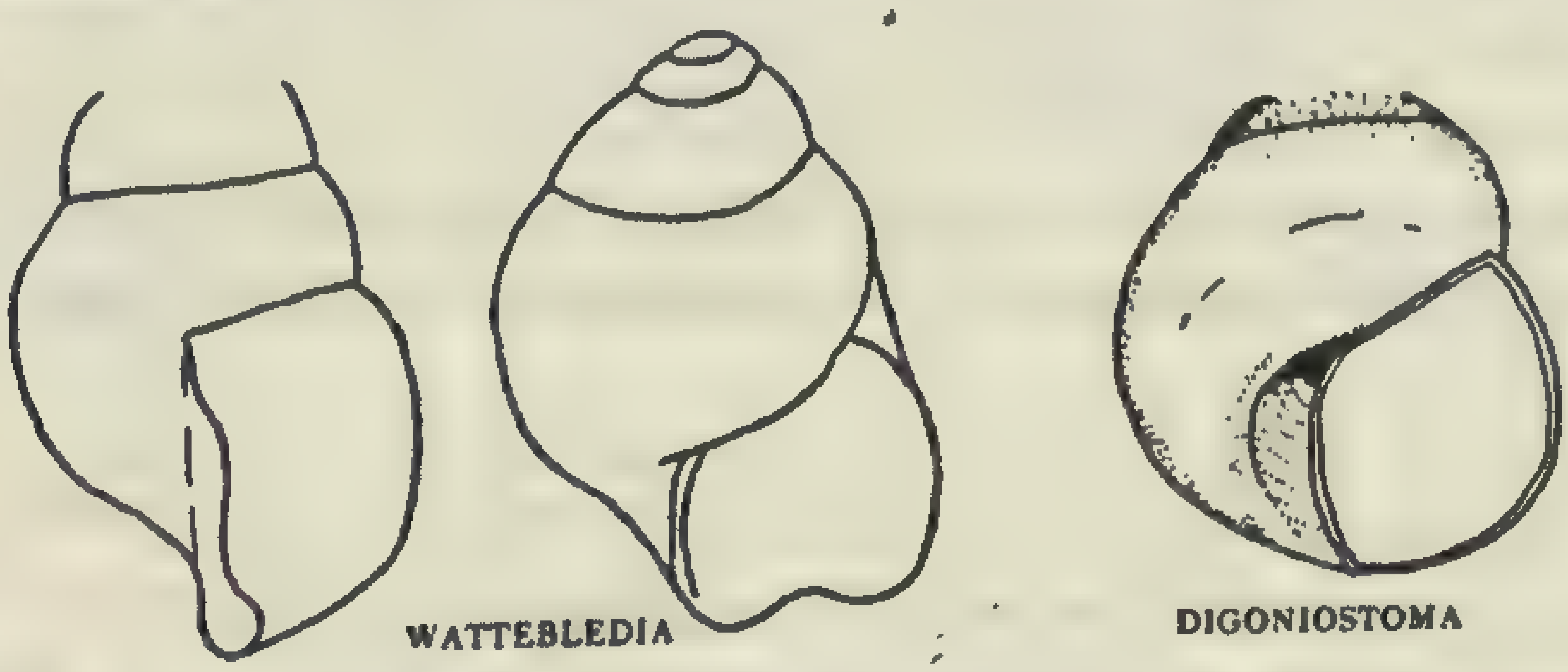


Fig. 10. *Wattebledia crosseana*, side view and oblique anterio-dorsal view to show sinuate lip. *Digoniostoma funiculata*, showing rim within deep umbilicus.

D. robusta A. Adams is found in southern China but appears to be an uncommon species. *D. funiculata* Walker is known only from Siam. There are three or four species in the East Indies and the Philippines.

Genus WATTEBLEDIA Crosse 1886

Wattebledia Crosse 1886, Journn. de Conchyl., **34**, p. 76 (Genotype: monotypic *Bythinia crosseana* Wattebled).

No member of this genus has been implicated as a disease carrier. One species, *W. crosseana* Wattebled 1884, occurs in the canals of southern China and in Indo-China. It is related to, and in appearance very much like *Bulimus,* except that the lip of the shell is sinuate or wavy. Adults are about 5 mm. or less in length and have approximately 4½ whorls. The operculum is calcareous, concentric with a small spiral nucleus in the center.

Family SYNCERIDAE

Genus SYNCERA Gray 1821

Nerita (subgenus) *Syncera* Gray 1821, London Medical Repository, **15**, p. 239 (Genotype: monotypic, *Nerita* (*Syncera*) *hepatica* Gray).

Assiminea Fleming 1828, Hist. British Anim., p. 275 (Genotype: monotypic, *Assiminea grayana* Fleming).

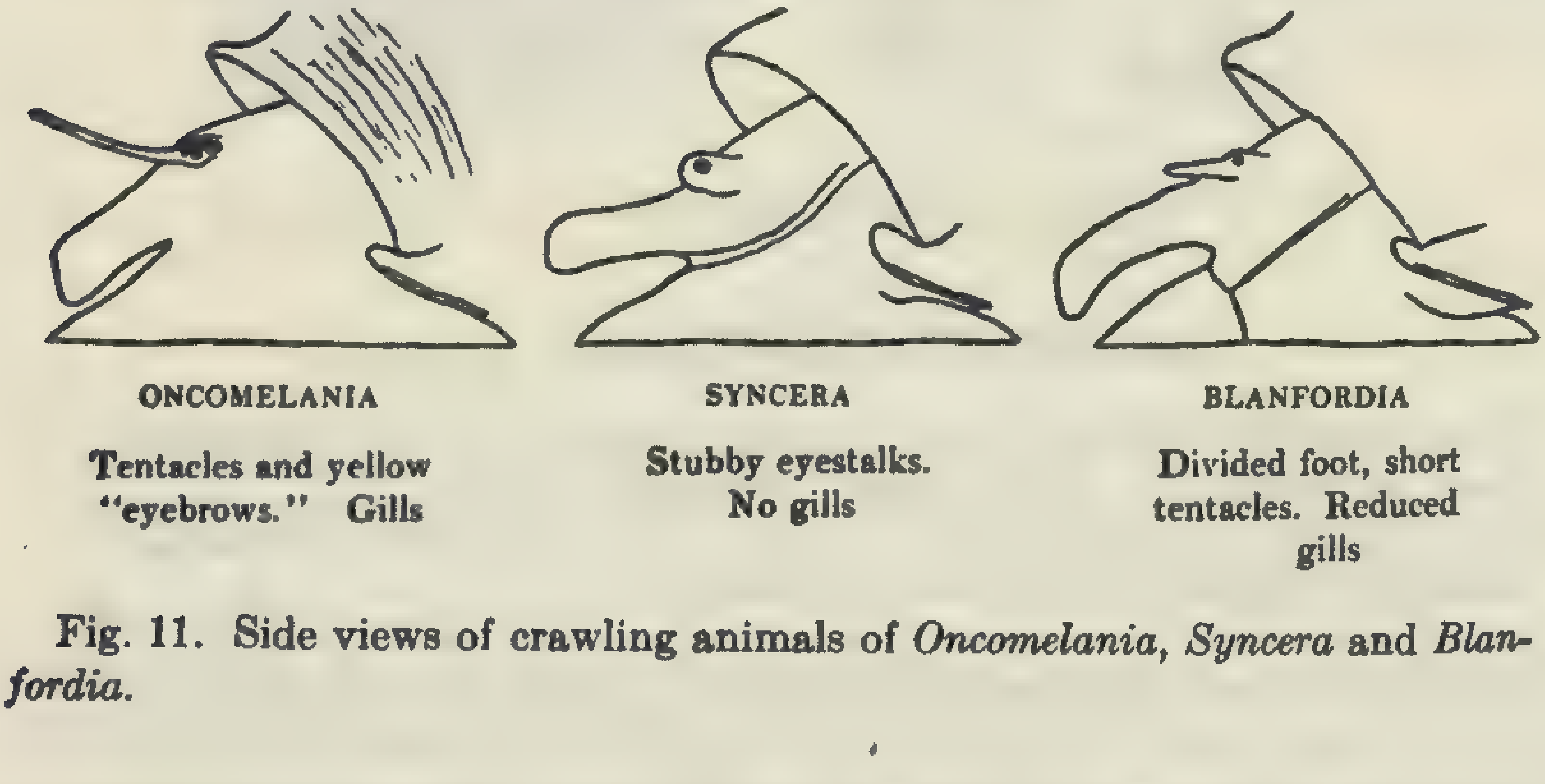
Members of this genus of small, amphibious mollusks are common throughout most parts of the world. They have not been implicated as schistosome carriers, but in the Philippines and China they are apt to be mistaken for *Oncomelania.*

The shell is usually less than one quarter of an inch in length, ovate-conic, compact, and never with the thickened outer lip or varix of *Oncomelania.* In some species, there is a small distinct spiral thread running around the whorls just below the suture. The shell may be dark brown, light horn, reddish cream, with or without spiral color bands. The operculum is very much like that of the *Oncomelania,* being thin, corneous, almost colorless, paucispiral with the nucleus excentric.

The animal does not have true tentacles but, instead, two short stunted eyestalks in which are embedded the round black eyes (See text figs. 5 and 11). A deep oblique furrow in the flesh on each side of the body divides the head and proboscis from the lower foot. The pedal gland may be seen as a cluster of white granules embedded near the anterior end of the foot. Males have a single-pronged verge, which is variable in shape in different species. There are no gills, and respiration is by means of a lung which opens to the right side of the mantle. Behind the eye there is often a color streak of white, cream or orange.

Oncomelania have not been collected from the same habitat as that of *Syncera* in the Philippines; but in China there are a few species, such as *S. colombeliana* Heude (Plate 1, fig. 14), that are commonly found with *O. hupensis* Gredler and *O. nosophora* Robson.

In the Philippines, *Syncera* is commonly found in large, amphibious colonies along the grass banks of marshy estuaries and along large rivers as far inland as the influence of the tides. The snails are capable of moving about under water for long periods of time, but they prefer to remain out of water in moist places that are shaded by low grass. They are rapid crawlers, and are negatively phototropic. Bits of dead meat will attract them overnight to one spot. If kept dry and away from temperatures over 80° F., they will survive dessication from one to two weeks.



ONCOMELANIA

Tentacles and yellow "eyebrows." Gills

SYNCERA

Stubby eyestalks. No gills

BLANFORDIA

Divided foot, short tentacles. Reduced gills

Fig. 11. Side views of crawling animals of *Oncomelania*, *Syncera* and *Blanfordia*.

Many hundred *Syncera* from the endemic schistosomiasis areas in the Philippines have been examined for cercariae with negative results. It is interesting to note, however, that the miracidium of *S. japonicum* is strongly attracted to *Syncera*, but all attempts to infect Philippine species artificially have failed.

Syncera lutea A. Adams 1861 of southern China (identification of this species problematical) has been reported as an intermediate snail host of *Paragonimus westermani* by H. T. Chen (1935, Lingnan Sci. Journ., **14**, 4, p. 695).

No attempt is made here to list or differentiate the 100 or so species described from the Pacific and Orient. On Leyte Island, Philippines, as many as four distinct species have been found living in proximity to each other along the same river bank. The shells do not vary in character as do the *Oncomelania*. Shell shape and color, animal color, and verges can be successfully used to separate species.

A new species of *Syncera* from Mindanao Island, Philippines, and a subspecies of it from Dinagat Island are given here because of their remarkably close resemblance in shell characters to *Oncomelania quadrasi*. The absence of tentacles, and the presence of a subsutural thread on the shell will separate these *Syncera* from *Oncomelania*.

SYNCERA PSEUDOQUADRASI, new species

Plate 1, figs. 11–13, Text fig. 12

Adult shells about 3.0 to 4.5 mm. in length, elongate-ovate, strong, color a rich chestnut brown. Nuclear whorls (developed in egg mass) about two in number, rounded, glassy and lightly tinged with brown. Postnuclear whorls rounded, with the body or last whorl about ½ of the total length of the shell. Extremely fine axial sculpture of slightly retractively slanting lines of growth. There is a very distinct, single, raised thread running spirally around the whorls a little below the

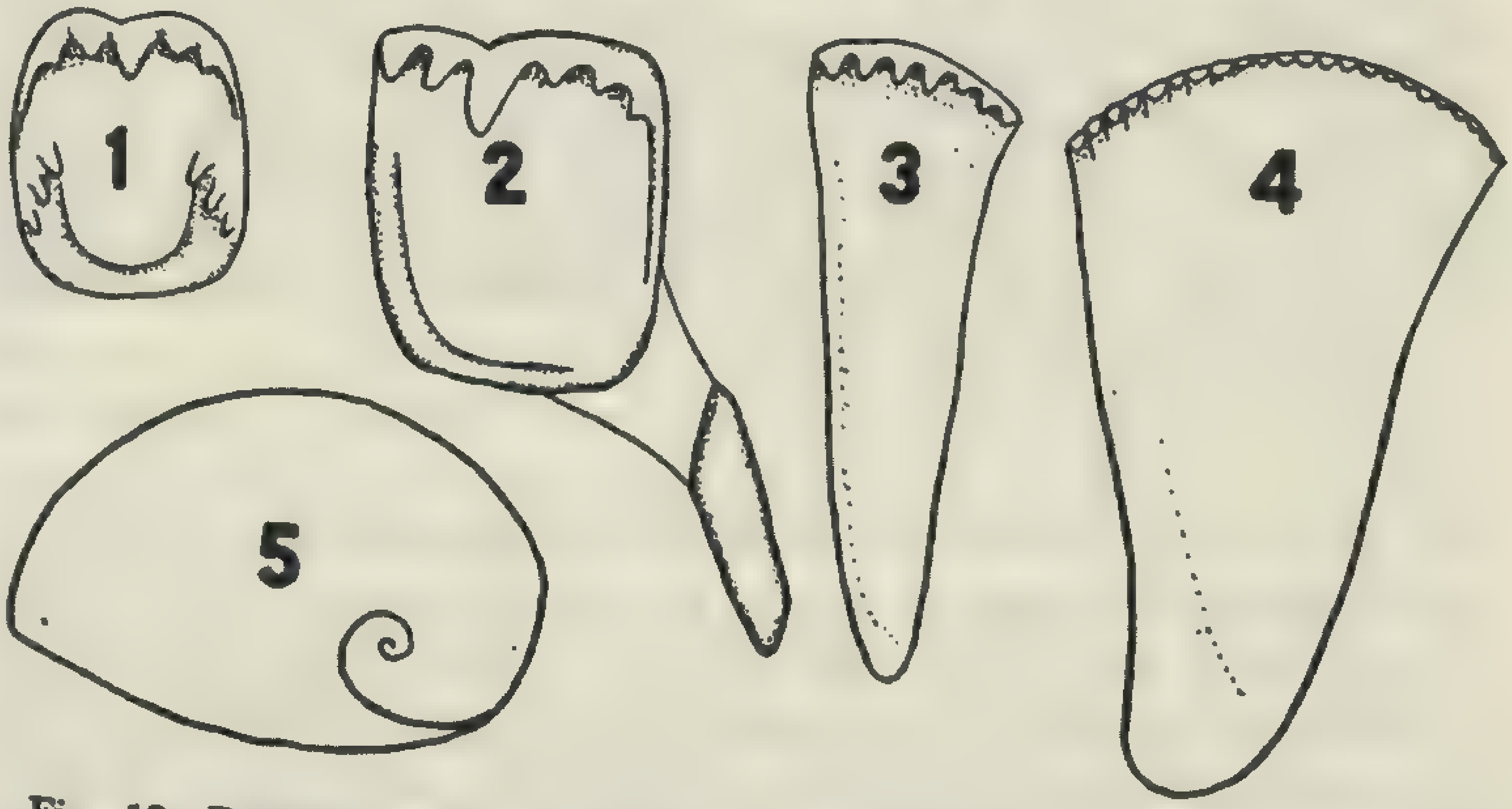


Fig. 12. Radular teeth of *Syncera pseudoquadrasi* new species. (1–4). Rachidian, central, inner marginal and outer marginal teeth. (5). Operculum.

suture. Umbilicus narrow and slit-like. In young specimens there is a spiral carina bordering the umbilicus. Columella strong, rounded, and colored a very light tan or whitish. The outer lip of the shell is sharp and never thickened into a varix. Opposite to and at the bottom of the columella the lip is slightly reflexed.

The eyestalks are typically Syncerid and there are no true tentacles. The penis is long and slender. The operculum is thin, translucent, paucispiral.

The radula has a small oval rachidian with an anterior denticle count of 2-1-2 and with three pairs of well formed basals. The lateral has a denticle count of 2-1-3. The handle is detached from the blade. The inner marginal is long and slender and has a denticle count of from 7 to 8. The outer marginal is fan shaped with about 22 small denticles.

Type Locality: Bugo, Macajalar Bay, northern Mindanao Island, Philippines. M. S. Ferguson, collector, 1945. The holotype is deposited in the Museum of Comparative Zoology, no. 175325. Paratypes are in the M.C.Z., no. 175326 and the United States National Museum, no. 485564.

Length	Width	No. of whorls	
4.5 mm.	2.3 mm.	7	Holotype
4.1	2.2	6	Paratype
3.7	1.8	5	"

Remarks: This species is related to *Syncera quadrasi* Moellendorff 1895 (Masbate Island), but the shell is much higher and less globose. In *S. quadrasi* the length of the last whorl is about ¾ the entire length of the shell, while in *pseudoquadrasi* the last whorl is about ½ the entire length of the shell. In shell texture, color and sculpturing the two species are very similar. Among 200 paratype specimens, a single, fresh, albino individual was found.

SYNCERA PSEUDOQUADRASI DINAGATENSIS, new subspecies

The shell and radula are identical with *pseudoquadrasi* in all observable characters, except for the color of the columella and the columellar callus which in *dinagatensis* is a very dark, blackish brown. In *pseudoquadrasi* the columella is a light tan to whitish. Among 75 paratypes, two fresh, albino specimens were found in which the shells are grayish white.

Type locality: Panamoan, Dinagat Island, northeast of Mindanao Island, Philippines. M. S. Ferguson, collector, 1945. Holotype in the Museum of Comparative Zoology, no. 175323 and paratypes in M.C.Z., no. 175324 and U. S. N. M., no. 485565.

Length	Width	No. of whorls	
3.1 mm.	1.7 mm.	5	Holotype

Family THIARIDAE

The *Thiaridae* are a widely distributed family of operculate snails, comprising many genera and several hundred species living in fresh and brackish water. A number of Oriental species are important as first intermediate hosts of trematodes belonging to the superfamilies *Heterophyoidea* (*Metagonimus, Haplorchis* and *Diorchitrema*) and *Troglotrematoidea* (*Troglotrema* and *Paragonimus*). This family has been usually referred to as "*Melania*" in medical literature.

The type of reproduction of the snail is generally used to define the natural groupings. Genera and species are usually separated by the shape and sculpturing of the shell, the characters of the mantle edge, and on rare occasion the radula and operculum. Many well known species will have to await examination of their animals before being correctly assigned to genera.

Several types of reproduction appear to be present among the Thiarids of the Orient and Pacific Areas. Limited to the species of *Thiara* and *Brotia* so far examined, is the neck brood pouch, a large cavity behind the head where newly hatched young remain for a period of one to three weeks before being liberated. In *Thiara*, developing eggs are passed from the ovaries into the posterior end of the pouch and finally hatch as young snails of one to two whorls. The pouch is transversely crossed with lamellae of adventitious tissue, but the active and more advanced young of four to five whorls continually break through the interlocking compartments and feed on calcareous concretions and on smaller young present in the pouch. Liberation takes place, independently of the stage of growth, through a "birth pore" on the right side of the pouch. The young snail is passed spire first through the pore and carried down an exterior groove on the parent's side by means of minute cilia. The brood pouches of *Thiara granifera* Lamarck and *scabra* Müller usually contain at one time four to six young from 1.0 to 3.0 mm. in length, ten to thirty recently hatched individuals of varying size, several dozen eggs and a number of hard, irregular pieces of calcium carbonate each less than a millimeter in diameter. The production of young in the above species was continuous throughout the year on Guam Island. Old specimens of unusually large size contained no young in their brood pouches. The *Thiara* species are presumably parthenogenetic, no males having been found in nature.

The genus *Brotia* possesses a neck brood pouch similar to that found in *Thiara* except that the pouch extends back into the visceral mass, with much thinner tissue walls, possesses no "birth-pore" at the side, and bears 50 or more young of smaller, uniform size. The manner of escape of the young is unknown, although it may be possible that the pouch ruptures at its posterior end, liberating the young all at one time.

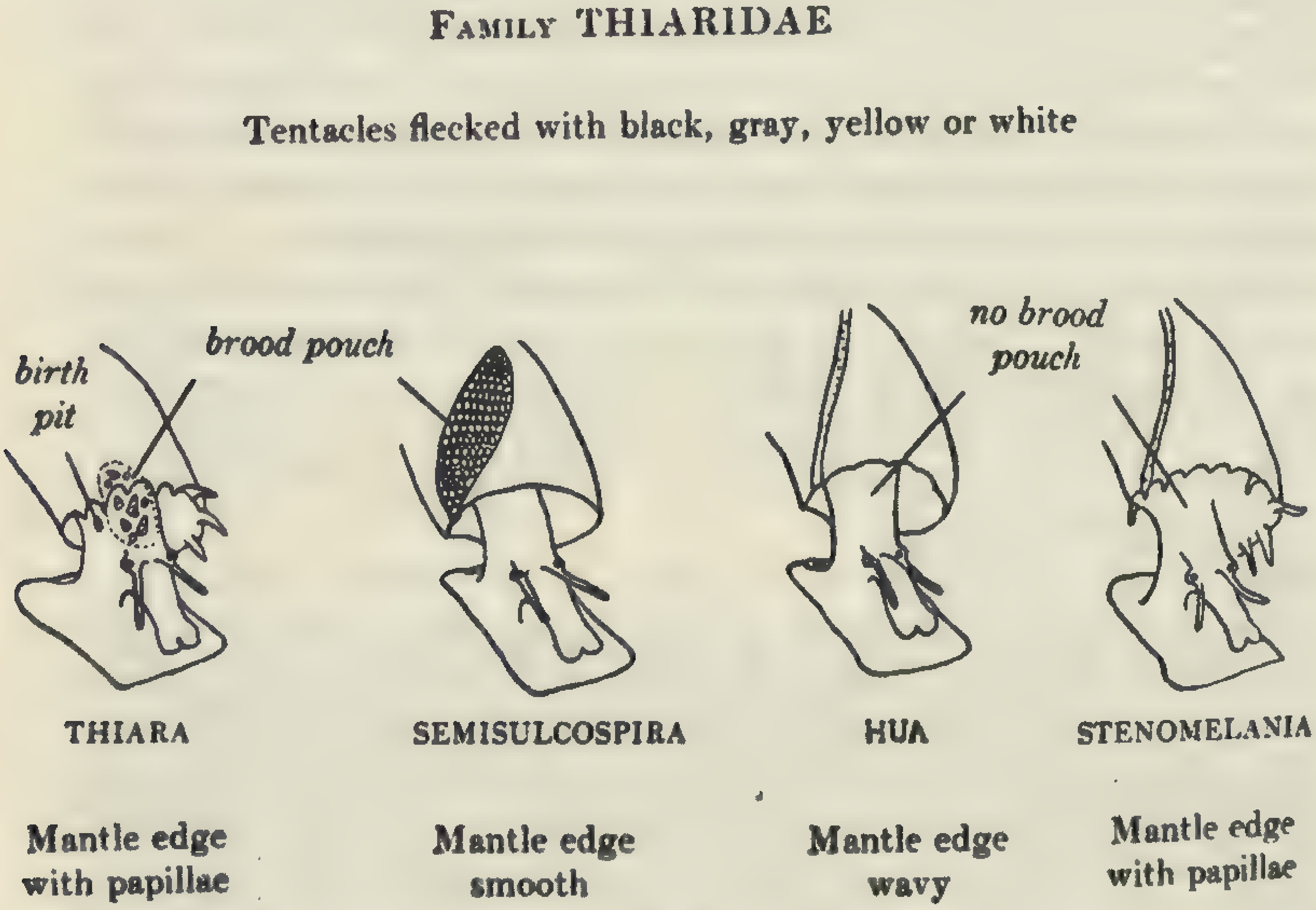

Family THIARIDAE
Tentacles flecked with black, gray, yellow or white
birth pit
brood pouch
no brood pouch
THIARA
SEMISULCOSPIRA
HUA
STENOMELANIA
Mantle edge with papillae
Mantle edge smooth
Mantle edge wavy
Mantle edge with papillae

Fig. 13. Dorsal and side views of animals of *Thiaridae.*

Other modifications in reproduction occur in several genera of Thiaridae, but suitable material has not been available for study. When genotypic species have been examined from all parts of the world, a complete revision will be possible.

Members of the genus *Semisulcospira* are unique in possessing a uterine brood pouch. Dr. J. P. E. Morrison, first to notice this in

Navy and Army material sent to the United States National Museum, has worked out the gross reproductive anatomy (forthcoming report). His observations, and subsequent dissections by the author, show that the uterus which is welded to the inner and right side of the mantle becomes swollen and packed along its entire length with hundreds of very small young. The posterior end contains closely packed rows of eggs, the anterior end supporting among its lamellae of thin tissue the ovoviviparous young of two whorls of growth. Kajimoto (Folia Ant. Jap., Tokyo, 1932, p. 441) has reported on spermatogenes is in *Semisulcospira libertina* Gould.

A fourth type of reproduction does not involve the retaining of young within a brood pouch, but appears to be an oviparous mode in which eggs are laid. Little is known about the life histories of this type which includes the genera *Stenomelania* (Western Pacific), *Hua* (China), and *Paludomus* (Ceylon and Southern Asia). The groove on the right side of the body extends down to the edge of the foot and is used in the act of egglaying.

The mantle edges of the *Thiaridae* are of five kinds, and although they are not used in defining subfamilies, as are the types of reproduction, they are useful in separating certain genera.

1. Mantle edge with about 14 fleshy protuberances or papillae, the furthest four to the left being largest — *Stenomelania, Thiara* (and its subgenera, *Plotiopsis, Tarebia*, etc.)
2. Mantle edge with 20 to 25 fleshy papillae, all small and the same size — *Paludomus.*
3. Mantle edge nearly smooth, but with a dozen or so slight undulations — *Hua.*
4. Mantle edge smooth and with a small, fleshy, cup-shaped fold on the right side opposite the anal opening — *Brotia.*
5. Mantle edge smooth but without the cup-shaped fold — *Semisulcospira.*

The opercula of the *Thiaridae* are always corneous and in most instances are opaque, dark brown. All have a spiral growth, but the position of the center of the whorls and the rapidity in which the whorls increase vary in the several genera. In *Brotia*, the operculum is almost round and is multispiral. Most of the opercula of *Thiara* and *Stenomelania* are oblong in shape and the nucleus of the whorls is set off to one corner, so that often in corroded specimens this feature cannot be seen. In *Semisulcospira*, the operculum is ovate and paucispiral with the nucleus nearer to the center than that of *Thiara*. That of *Paludomus* is round with concentric rings.

The tentacles of the animal are round, slightly tapering and approximately the length of the expanded foot. They are characteristically colored with flecks of black, yellow, white or gray. The small black eyes are located at the base of the tentacles which are very slightly swollen. A row of low, plate-like gills is attached to the roof of the mantle. There is no external verge or penis. The proboscis is as long as the foot, is cleft in front where the mouth is situated, is round on top, but almost flat underneath. In many species the proboscis is colored with a series of transverse black lines. The shape of the underside of the foot is square in *Stenomelania* and oblong in most other genera. In some species the underside of the foot has tiny pink or yellow dots. A review of animal characters is given in text figure 13.

Each row of the radula ribbon in the Oriental *Thiaridae* has 7 large teeth. The rachidian is the smallest, is almost square in outline, has 5 to 7 denticles on the anterior edge, but has no basals. The lateral tooth has from 5 to 8 denticles in which the first or second is very large. The inner and outer marginals are similar to each other in size and shape and generally have only two or three large blunt denticles.

Many years of collecting and study will be necessary before our knowledge of speciation and distribution will allow a reasonably stable condition of nomenclature. In addition, recent research in the literature has brought about major name changes which temporarily have added to the confusion. These changes are being accepted almost universally and will contribute to the stability of *Thiaridae* nomenclature. Thus, *Melania* Lamarck 1799 is now *Thiara* Röding 1798. As has been previously pointed out by other workers, the generic name *Acrostoma* Brot was used earlier by Le Sauvage for a genus of Cestodes; *Brotia* A. Adams 1874 is now the accepted name. The name *Plotia* Röding, by subsequent type designation, has been removed (Pilsbry and Bequaert 1923) from the *Thiaridae* and applied to a genus of marine shells (*Pyramidella* Lamarck).

At present, only three genera, *Semisulcospira, Hua* and *Thiara* (subgenus *Tarebia*), have been implicated with certainty as carriers of *Paragonimus westermani* Kerbert.

Genus THIARA Roding 1798

Thiara Röding 1798, Museum Boltenianum, **2**, p. 109 (Genotype: *Helix amarula* Linnaeus, the other species mentioned by Röding being *nomina nuda*).

Melania Lamarck 1799, Mem. Soc. Hist. Nat. Paris, p. 75 (Genotype: monotypic, *Helix amarula* Linnaeus).

This genus is distributed in tropical and semi-tropical countries from Africa to southern China, throughout the Philippines, the East Indies and the South Sea Islands. Some species are found as far north as Formosa and the Ryukyu Islands and as far south as Australia. Members of this genus are commonly found in brooks, rivers, ponds and ditches, although a few are found in slightly brackish water.

The animal of *Thiara* is characterized by its mantle edge which has from 10 to 14 fleshy papillae, the largest 4 being on the left side. The inside of the mantle is often tinged with a bright hue of blue green or emerald green. The large proboscis swings from side to side in elephant-like fashion as the snail is crawling forward. The color of the animal is variable — black, gray or brown splotches over which are varying shades of yellow or white. The proboscis is usually transversely striated with strong, and often V-shaped, lines of jet black. The young are produced ovoviviparously.

The species of this genus have been grouped for conchological convenience into several subgenera on the basis of shell differences. The subgeneric names are included in parentheses.

The typical species, *Thiara* (*Thiara*) *amarula* Linnaeus is found from East Africa, throughout the Indian Ocean Islands to Melanesia in the Pacific. The shell has a black periostracum and is from 1 to 2 inches in length. The length of the aperture is equal to or greater than half the length of the entire shell. A flat, slightly sloping ridge runs spirally just below the suture, on the outer edge of which are prominent, vertically projecting spines. The shell characters of the Javanese *Thiara* (*Tiaropsis* Brot 1874) *winteri* Philippi 1842 are intermediate between *Thiara* (*Thiara*) *amarula* Linnaeus and *Thiara* (*Plotiopsis* Brot 1874) *scabra* Müller.

Subgenus MELANOIDES Olivier 1807

Melanoides Olivier 1807, Voyage à l'Emp. Ottoman, **2**, p. 40 (Genotype: *Nerita tuberculata* Müller).

[*Plotia* Röding by type designation of Pilsbry and Bequaert 1923, Nautilus, **37**, p. 36, is not a *Thiaridae* but a marine shell (*Pyramidella* Lamarck 1799)].

THIARA (MELANOIDES) TUBERCULATA Müller

Plate 3, fig. 13

Nerita tuberculata Müller 1774, Verm. Terr. Fluv. Hist., **2**, p. 191 (coast of Coromandel, India).

This species has not been conclusively implicated as an intermediate host of either *Clonorchis* or *Paragonimus* although Gaillard (1938) insists on epidemiological grounds and on two naturally infected specimens that this species is the common host of *Clonorchis* in the Tonkin Area. Katsuta (1932) gives the variety *hahajimana* Pilsbry and Hirase 1904 as the first intermediate host of *Diorchitrema formosanum.*

The shell is relatively slender and is never very thick. Adults are from 1 to 2 inches in length. The whorls are rounded, the suture between them well impressed. The sculpturing on the shell consists of numerous axial and spiral threads which sometimes form by their intersection a reticulate or nodular pattern. Some varieties lack most of the sculpturing, others have quite strong wrinkles or axial grooves just below the suture. In some localities, the shells are mottled with reddish brown streaks.

The processes on the edge of the mantle arise on the ventral surface a short distance behind the actual margin. The largest four papillae are on the left side, the others growing smaller as the series proceeds towards the right.

In the East Indies and the Philippines this species is represented by the subspecies *truncatula* Lamarck 1822; and in southern China as far north as Foochow, and in Formosa by the subspecies *chinensis* Nevill 1885.

Subgenus TAREBIA H. and A. Adams 1854

Tarebia H. and A. Adams 1854, Genera Recent Moll., **1**, p. 304 (Genotype: *Melania celebensis* Quoy and Gaimard = *granifera* Lamarck).

THIARA (TAREBIA) GRANIFERA Lamarck

Plate 3, fig. 4

Melania granifera Lamarck 1822, Hist. Nat. Anim. s. Vert., ed. 1, **6**, pt. 2, p. 167 with reference to Encycl. pl. 458, figs. 4a-b (Timor).

Melania celebensis Quoy and Gaimard 1834, Voy. Astrolabe, Zool., **3**, p. 152, pl. 56, figs. 26–29 (Manado, Celebes).

Melania obliquegranosa E. A. Smith 1878, Proc. Zool. Soc., London, p. 729, pl. 46, figs. 7–8 (Formosa).

This species has been implicated in Formosa as the first intermediate host of *Paragonimus westermani* Kerbert, *Haplorchis taichui* Nishigori and *Diorchitrema formosanum* Katsuta (as *Melania obliquegranosa*). *Thiara* (*Tarebia*) *granifera* Lamarck has a wide distribution from the East Indies, Melanesia, Micronesia, throughout the Philippines and north to Formosa. A large number of forms and subspecies have been described. This species prefers the clear running water of brooks, springs and rivers.

The shell grows from 1 to 2 inches in length, the last whorl being greater in length than half the entire length of the shell. The spire is usually sharp. The whorls are almost flat in the spire. The sculpturing consists of distinct spiral rows of tiny beads. In some localities the color of the shell is a rich chestnut brown, in others it is a light olivaceous brown.

The sides of the foot and body are mottled with black and gray over which are scattered light yellow patches. The tentacles are light gray with numerous encircling black flecks. The underside of the foot is usually colored a chalky gray and in some specimens with an additional pinkish cast. Over this are two or three dozen small, round yellow dots. The first five papillae on the edge of the mantle are large with bulbous bases which have yellow dots embedded in the flesh. The "birth pore" on the right side of the body is colored pink. The "brood pouch" contains from 20 to 30 young and numerous eggs. The interior of the mantle is flushed with blue green.

Subgenus PLOTIOPSIS Brot 1874

Plotiopsis Brot 1874, in Martini and Chemnitz, 1, 24, Melaniaceen, p. 7 (Genotype: *Melania balonnensis* Conrad. Australia)

THIARA (PLOTIOPSIS) SCABRA Müller

Plate 3, fig. 12

Buccinum scabrum Müller 1774, Verm. Terr. Fluv. Hist., 2, p. 136 (Tranquebar, Coromandal, India).

Melania pagoda Lea 1851, Proc. Zool. Soc. London, p. 197 (Guimaras, Philippines).

(Other synonymies by B. Rensch, Arch. Hydrobiologie, Suppl. 13, 1934).

The shells of this species and its numerous forms range in length from one to two inches, are often reddish in color, and are characterized by the presence of small spines or pronounced nodules on the shoulder of the whorls. The edge of the mantle has 13 to 14 papillae, the four largest being on the left side. The color of the underside of the foot varies from grayish to pinkish gray over which are numerous small pinkish yellow dots. A neck brood pouch is located under the skin on the dorsal side of the neck. Slightly behind this and to the right, is a small "birth pore" from which the live, red-colored young emerge spire first.

In the Marianas, this species is represented by a variety in which the shell is more elongate and the spines blunter than in the Philippine varieties. The color of the shell in different localities varies from light yellowish brown, superimposed with reddish brown splotches to an even olive drab or blackish olive. In nearly all instances, the spiral sculpturing is present in the form of many, fine, raised threads.

On small islands this species is found commonly in small upland brooks. In the Philippines, it is found in brooks and in rivers near the sea. *Thiara (Plotiopsis)scabra* Müller has not been authentically implicated as a disease carrier.

Subgenus SERMYLA H. and A. Adams 1854

Sermyla H. and A. Adams 1854, Gen. Recent Moll., **1**, p. 296 (Genotype: *M. tornatella* Lea).

THIARA (SERMYLA) RIQUETII Grateloup

Plate 3, fig. 5

Melania riquetii Grateloup 1841, Actes Soc. Linn. Bordeaux, **11**, p. 433 (reprint p. 47), sp. 44, pl. 3, fig. 28 (Bombay).

This is a small brackish water species which is distributed throughout the Indian Ocean, the East Indies and the Philippines. It is of no known medical importance. The shell is strong, cleanly sculptured, and reaches a length of about half of an inch. The animal, mantle edge, brood pouch and operculum are almost identical with those of the subgenera *Plotiopsis* and *Tarebia*, but it is separated into the subgenus *Sermyla* because of the distinct and little-varying, small, neat, axial ribs on the upper two-thirds of the whorls. These ribs slant anteriorly as they descend.

Genus SEMISULCOSPIRA Boettger 1886

Semisulcospira Boettger 1886, Jahrb. D. Malak. Gesell., **13**, p. 4 (Genotype: *Melania libertina* Gould).

Members of this genus have been conclusively implicated as the first intermediate hosts of *Paragonimus westermani* Kerbert. In several instances cercariae apparently indistinguishable from those of *Clonorchis sinensis* Cobbold have been found in these snails. This group of *Thiaridae* is found in Japan, Korea and Formosa. The mantle of the animal is smooth and lacks the long papillae characteristic of *Thiara* and *Stenomelania.* The operculum is paucispiral, corneous and opaque brown. A uterine brood pouch is present.

SEMISULCOSPIRA LIBERTINA Gould

Plate 3, figs. 6–7

Melania libertina Gould 1859 (June), Proc. Boston Soc. Nat. Hist., **7**, p. **42** (Simoda, and Ousima).

This species is considered the main intermediate vector of *Paragonimus westermani* Kerbert in the Orient. It has an insular distribution which extends from Japan and Korea, to Okinawa and Formosa. This species is extremely variable, and until larger collections are made, the nomenclature of its many forms, races and subspecies will remain confused. In all likelihood, "*Melania paucicincta*" von Martens 1894 was based on young specimens of *libertina* Gould. Muto in 1917 implicated *libertina* Gould in Korea as an intermediate host of *Metagonimus yokagawai* Katsurada. *Haplorchis pumilio* Looss (syn: *Monorchotrema taihokui* Nishigori, according to Faust, 1939) and *Diorchitrema formosanum* Katsuta are carried by forms of this species (form *hidachiensis* Pilsbry).

The following local forms were originally described from Formosa or since recorded from there: *tenuisulcata* Dunker, 1859, *plicosa* von Martens 1877, *microstoma* Nevill 1885, *sublaevigata* Nevill 1885, *subplicosa* Nevill 1885.

The described Japanese forms are: *reiniana* Brot 1876, *irrigua* von Martens 1877, *plicosa* von Martens 1877, *ambidextra* von Martens 1860, *japonica* Reeve Dec. 1859, *retifera* Tryon 1865, *yokohamensis* Hartman 1897, *hidachiensis* Pilsbry 1902, *gigas* Pilsbry and Hirase 1904, *tsushimana* Fulton 1914, *nassaeformis* Kuroda and Kanamaru 1932.

The adult shell of *libertina* Gould varies in length from three-fourths of an inch to two inches. It is somewhat spindle-shaped, and has slightly flattened whorls. The length of the aperture is equal to or slightly less than half the total length of the shell in unworn specimens. The spiral sculpturing consists of many small, raised threads which are generally more prominent on the base of the shell. Axial sculpturing when present is in the form of wrinkles or very low, short ribs set just below the suture. Some specimens are almost entirely smooth. The color of the shell varies in individuals from dark brown to light yellowish brown which is sometimes flushed with greenish blue. Young and some adults occasionally have three or four spiral streaks of dark brown in the shell.

In Japan, it has been observed by Muto that *libertina* Gould is omnivorous and that it feeds on decayed remains of water plants and animals. They are ovoviviparous, the young shells being produced in all seasons but most numerously in late spring and early summer. This species may be found on rocks in swiftly running brooks or in sluggish ditches.

SEMISULCOSPIRA LIBERTINA EXTENSA von Martens

Melania extensa von Martens 1894, Sitzungsber. Ges. naturf. Freunde Berlin, p. 212; 1905, Zool. Jahrb. suppl., **8**, p. 45, pl. 1, figs. 15, 16 (Kwangju, Korea).

This subspecies was found by Kobayashi in 1926 to carry *Paragonimus westermani* Kerbert. It is a variety of *libertina* in which the spiral sculpture on the base of the shell is quite prominent and in which the ribs just below the suture are prominent.

SEMISULCOSPIRA LIBERTINA MULTICINCTA von Martens

Melania multicincta von Martens 1894, Sitzungsber. Ges. naturf. Freunde Berlin, p. 212; 1905, Zool. Jahrb., suppl., **8**, p. 44, pl. 1, fig. 13 (Yongsongpo Korea).

This subspecies was found by Kobayashi in 1926 to carry *Paragonimus westermani* Kerbert in Korea. It appears to be a good variety of *libertina* Gould in which the whorls are well rounded and the spiral sculpturing prominent over the entire shell. There are also slight indications of a few low ribs just below the suture.

Genus HUA Chen 1943

Hua Chen, S-F., 1943, Nautilus, **57**, no. 1, p. 21 (Genotype: *Melania telonaria* Heude).

This genus appears to be restricted to the mainland of Eastern Asia. The animals are without brood pouches and are probably all egg layers. Females possess an indented groove which extends down the right side of the body to the edge of the foot. The mantle edge is almost smooth except for a dozen or so slight undulations. Chen erected the genus *Hua* on shell characters only, but the genotypic species *telonaria* Heude, together with *H. dolium* Heude, H. *jacquetiana* Heude, and *H. ningpoensis* Lea, possess the animal characters mentioned above. Other species included in the genus *Hua* by Chen will have to await dissection before finally being placed. The genus *Wanga* Chen 1943 also awaits further study before being accepted.

HUA (HUA) DOLIUM Heude

Plate 3, fig. 9

Melania dolium Heude 1890, Mém. Hist. Nat. Emp. Chinois, **1**, pt. 4, p. 166, sp. 450, pl. 41, figs. 24, 24a, 25, pl. 43, fig. 6 (Hiou-ning, Ngan-houe).
Semisulcospira dolichostoma Annandale 1924, Proc. Mal. Soc. London, **16**, pt. 1, p. 32, figs. 2b, 3a-b (Yenchow, Chekiang).

This is a fairly common species found in swift rivers and hillside brooks throughout most parts of China, except perhaps in the extreme South. The shell characters are quite variable. Either closely related species, subspecies or forms are the names *graniperda* von Martens 1905, *bailleti* Bavay and Dautzenburg 1910, *kingi* Ping 1938, and *lauta* Fulton. No members of the *dolium* complex have been implicated, as yet, as *Paragonimus* carriers,

Hua dolium Heude is spindle-shaped, about twice as long as it is wide, and is about one inch in length. The aperture is almost half as long as the entire length of the shell. The surface of the shell is marked by approximately a dozen strong, raised, spiral ribs. The color of the shell is generally a light yellowish brown to a light chestnut brown. In a few adult specimens and especially the young, there may be one to three spiral streaks of dark chestnut brown on the inner surface of the shell. The mantle edge in the animal is undulated and without papillae.

HUA (HUA) AMURENSIS Gerstfeldt

Plate 3, figs. 10–11

Melania amurensis Gerstfeldt June 1859, Mem. Savants Ets. Acad. Imp. Sci., St. Petersbourg, **9**, p. 512, pl. 1, figs. 14–24 (Amur River).

Melania heukelomiana Reeve Dec. 1859, Conch. Icon., **12**, Melania, sp. 123, pl. 17, fig. 123.

Melania gottschei von Martens 1886, Sitzungsber. Ges. naturf. Freunde Berlin, p. 78 (Hangang near Seoul, Korea); 1905, Zool. Jahrb., suppl., **8**, p. 26, pl. 1, figs. 1–1b and fig. A (text).

Melania tegulata von Martens 1894, Sitzungsber. Ges. naturf. Freunde Berlin, p. 211 (Chitsan, Korea); 1905, Zool. Jahrb., suppl., **8**, p. 32, pl. 1, figs. 17–18.

Melania nodiperda and varieties *connectens*, *pertinax*, *quinaria* von Martens 1894, Sitzungsber. Ges. naturf. Freunde Berlin, pp. 207–210 (Korea).

This species and several of its varieties were implicated by Kobayashi in 1926 as the first intermediate host of *Paragonimus westermani* Kerbert. It is found in northern China and Korea. A closely related species *nipponica* E. A. Smith 1876, with several ecologic forms, is found in the Biwa lake region of Japan.

Hua amurensis Gerstfeldt is a solid shell, from one half to one inch in length, and usually has a dark brown color. The spire is more extended and the aperture proportionately smaller than in *H. dolium* Heude. The sculpturing is very heavy; most characteristic are two or three very strong spiral cords on the base of the shell or lower two thirds of the whorl. On the top third of the whorl there are one, two or three spiral rows of blunt ribs, or in some cases, coarse nodules. The operculum is thick, corneous, and a dark, opaque, chestnut brown. The animal of this species has not been examined, and is provisionally included in *Hua*, although subsequent work may place it in the genus *Semisulcospira*.

Subgenus NAMRUTUA new

The subgenus *Namrutua* is characterized by its operculum which is semi-transparent, thin, and almost colorless except for a light tan stain. The aperture of the shell is small compared to the rest of the shell, its length being approximately less that one third the entire length of the shell. In *Hua s.s.*, the operculum is thick, corneous, and colored a dark, opaque brown, and the aperture is approximately one half the entire length of the shell. In both groups the mantle is undulated and without long papillae. The subgenotype is designated as *ningpoensis* Lea 1856. The only other known species in the subgenus is *suifuensis* Chen 1937. *Namrutua* is named after the U. S. Naval Medical Research Unit 2 (NAMRU-2).

HUA (NAMRUTUA) NINGPOENSIS Lea

Plate 3, fig. 8

Melania cancellata Benson 1842, Ann. Mag. Nat. Hist., **9**, p. 488 (Non Say 1829).

Melania ningpoensis Lea 1856, Proc. Acad. Nat. Sci., Philadelphia, **8**, no. **4**, p. 144 (Ningpo, China).

This species was shown by Faust and Barlow in 1924 to be commonly infected with *Clonorchis sinensis* in Shaoshing, China. It is very common in the canals and small rivers of central and eastern China. It is easily distinguished from other species of *Hua* by its translucent operculum, and by the even, strong, curved ribs on the upper two-thirds of the whorls which contrast markedly with the three or four smooth, distinct spiral ridges on the base of the last whorl. The lip of the shell is thin, sharp and easily broken. The whorls are fairly well rounded, and the spire is extended so that the aperture is from one-third to one-fourth the entire length of the shell (one-half to one inch). The color of the shell is a light yellowish brown. The operculum is paucispiral, thin, semi-transparent and smaller than the size of the aperture.

The mantle of the animal has a wavy edge and is without long papillae. The interior of the mantle is flushed with bright emerald green. The tentacles are dull cream yellow with black flecks. The proboscis and side of the foot are an opaque cream yellow with black striations. The underside of the foot is slate gray with a broad band around the edge of small brownish orange, or sometimes yellowish pink, color dots. There is very little swelling at the base of the tentacle where the eye is located. The animal is an egg layer.

Hua (Namrutua) suifuensis Chen 1937 from Szechuan Province, China is a closely related species in which the spiral ridges on the base of the shell have become obsolete. The axial ribs are more numerous and not as strongly developed as in *ningpoensis* Lea.

Genus STENOMELANIA P. Fischer 1885

Stenomelania P. Fischer 1885, Manuel de Conchyl., p. 701 (Genotype by original designation: *M. aspirans* Hinds).

This genus of *Thiaridae* has a great number of species which are common throughout the East Indies, the Philippines and Melanesia. Members of this genus are not known to be of medical importance, but they are mentioned here because several species are commonly found in tropical rivers and creeks of the South Western Pacific area. The shells are very high and drawn out. They are either entirely smooth or have spiral threads or rows of beads. The mantle edge is similar to that found in the genus *Thiara* in that it has papillae, but the animal does not have a "brood pouch" for young. A photograph of *Stenomelania fuscata* Born from Guam Island, Marianas is given on plate 3, figure 2.

Genus BROTIA H. Adams 1866

Brotia H. Adams 1866, Proc. Zool. Soc. London, p. 150 (Genotype: monotypic, *M. pagodula* Gould).

This group of *Thiaridae* is of no known medical importance. The shells are large for this family, reaching a length of two or three inches. They may be distinguished from all other *Thiaridae* genera by the perfectly smooth mantle edge and multispiral rounded operculum. In the Philippines, *Brotia asperata* Lamarck 1822 is a common species found in the tiny, mountain brooks where the water is cool. (Plate 3, fig. 1). This species will crawl out of water during a rain. The Indian species *Brotia variabilis* Benson 1836, is found from the Ganges Delta, India, to Melanesia. It inhabits large muddy rivers. Bequaert in 1927 erroneously lumped all the medically important *Thiaridae* of the East under the genus *Brotia*. The genus name *Acrostoma* Brot 1871 (*non* Le Sauvage 1827) is a synonym of *Brotia*.

Genus BALANOCOCHLIS P. Fischer 1885

Balanocochlis P. Fischer 1885, Manuel de Conchyl., p. 701 (Genotype: monotypic, *M. glans* v. d. Busch).

This genus is of no known medical importance. It is represented in the Philippines and the East Indies by the species *inermis* Lesson 1830 (syn: *glans* v. d. Busch) which is found in swiftly flowing rivers where rocks afford protection. *B. inermis* is about an inch in length, very stout, smooth and with a low spire. The thin epidermis covering the outside of the shell is greenish gray in life, but flakes off in old and dead specimens (See plate 3, fig. 3).

Family PLANORBIDAE

The planorbid snails are world-wide in distribution and play an important part in the life cycle of many trematodes. In certain of the West Indies and northern South America, the genus *Australorbis*, a member of this family, serves as the intermediate host of *Schistosoma mansoni* Sambon. In the East, however, only the planorbids belonging to the subfamily *Segmentininae* are of medical interest, and these serve as intermediate hosts of *Fasciolopsis buski* Lankester.

The planorbids are essentially shallow water and littoral snails. Certain species thrive in large lakes and ponds, while others are generally limited to small pools or ditches that frequently become dry. The breathing organ of the *Planorbidae*, a modified lung as in the family *Lymnaeidae*, is supplemented by a prolongation of the anal region (auriform lobe), called the pseudobranch or false gill, which may take over the function of breathing when the animal is submerged and cannot obtain free air.

The foot of the planorbids is simple, elongate and often tapering to a point behind (See text figure 14). Above and in front of the foot is a broad and short fleshy portion called the velum which bears the head, eyes and tentacles. The tentacles are fairly long, and slender, their bases being flattened at their juncture with the head. The two small black eyes are situated at the inner bases of the tentacles. The respiratory opening and pseudobranch or false gill are on the left side of the body. The genital outlets are on the left side of the neck. (In the *Lymnaeidae*, comparable organs are situated on the right side). The planorbids are hermaphroditic with the organs of the two sexes in the same individual.

The classification of most of the planorbids has been based on the morphology of the reproductive system which entails specialized dissection. A detailed account of the morphology and classification may be found in "The Molluscan Family Planorbidae" by Frank Collins Baker, 1945, the University of Illinois Press, Urbana.

The lingual ribbon or teeth of the *Planorbidae* carry many teeth in transverse rows as in the family *Lymnaeidae*. There may be as many as 200 rows with 85 teeth in a row or a total of 17,000 teeth in one ribbon.

Subfamily SEGMENTININAE F. C. Baker 1945

A group of planorbid genera, such as *Segmentina* and *Hippeutis*, whose shells are small, low, ultradextral, smooth and very glossy. The last whorl embraces the shell, and the aperture is nearly heart-shaped. (See text figure 14). Many species are carriers of several trematode larvae, including *Fasciolopsis buski*, the intestinal fluke.

These small, bright, glossy shells are found abundantly in the lakes, ditches and creeks of the East Indies and Asia. They occur in relatively clear, cool water in company with certain species of *Lymnaea*, *Viviparus*, *Oncomelania* and *Thiara*. They are not found in warm, semi-permanent pools and ditches where water is apt to be absent during dry spells, and for this reason the absence of these two genera, *Segmentina* and *Hippeutis*, is usually an indication that conditions are adverse for *Oncomelania*. *Gyraulus*, another similar-appearing genus of planorbids (See p. 000) can, however, thrive in small, warm bodies of water where *Oncomelania*, *Viviparus* and *Segmentina* are absent.

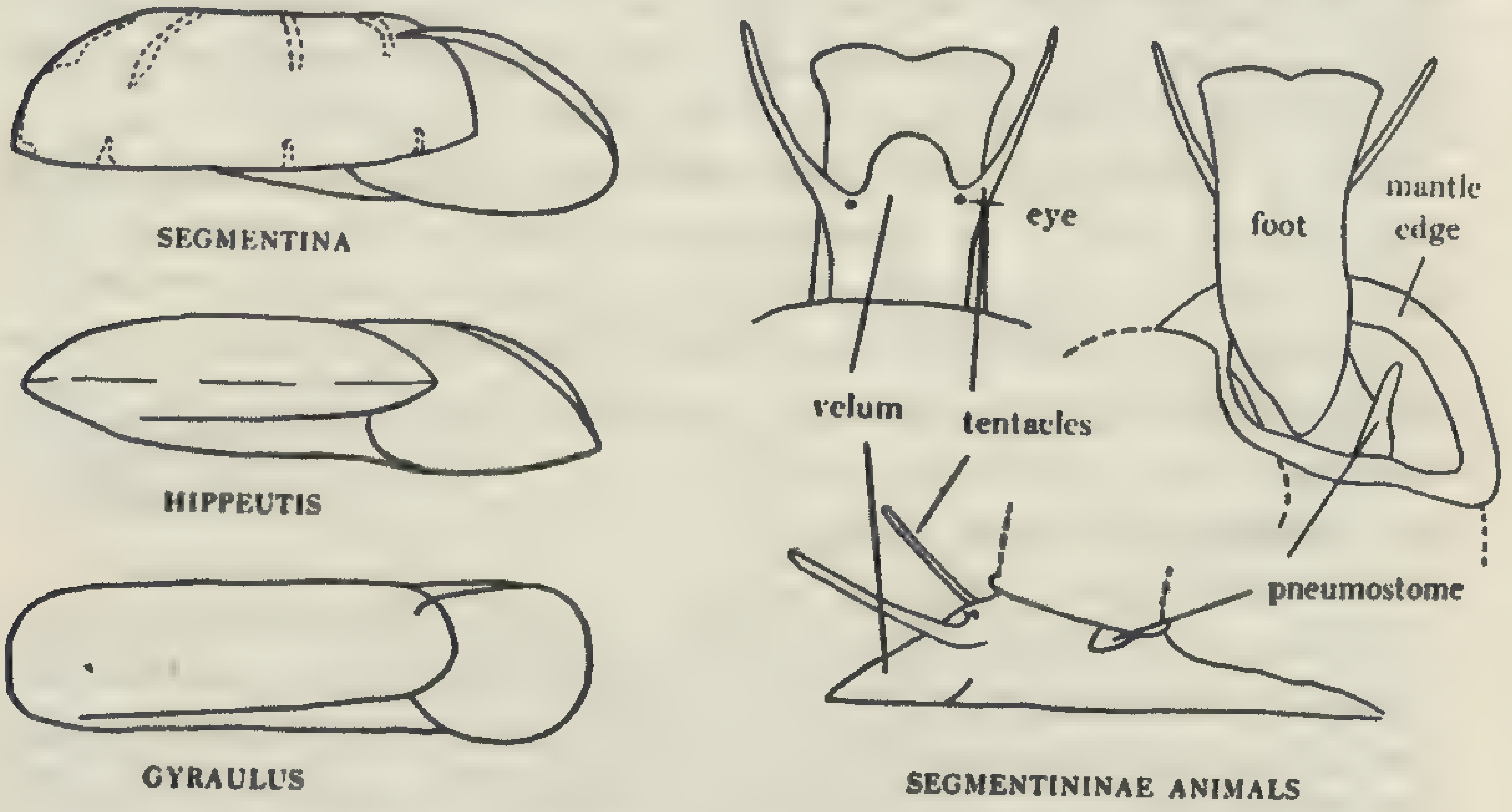


Fig. 14. Outline of shells of *Segmentina hemisphaerula*, *Hippeutis cantori* Benson and *Gyraulus* and animals of the subfamily *Segmentininae*.

Genus SEGMENTINA Fleming 1818

Segmentina Fleming 1818, Encyclopedia Britannica (suppl. to eds. 4–6), 3, (1), p. 309 (according to Neave, 1940, Nomenclator Zoologicus) (Genotype: *Nautilus lacustris* Lightfoot = *Planorbis nitidus* Müller).

Hemithalamus Leach 1819, Moll. Brit. Synop. (proofs), p. 137.

Segmentaria Swainson 1840, Treat. Malac., p. 337, Lapsus for *Segmentina* As subgenus of *Planorbis.*

Discus Gray 1847, Proc. Zool. Soc., p. 509. No type cited. As synonym of *Segmentina.*

The shells in this genus have small, calcareous barriers or lamellae inside the whorls (See text figure 14), usually four or more in a shell. Each barrier has three tooth-like bars placed close to one another. The genus *Segmentina* has been divided by F. C. Baker into two subgenera. All species of *Segmentina* from China, Japan, India, and the East Indies belong in the subgenus *Polypylis* Pilsbry 1906. *Segmentina,* sensu stricto, has a single species, *S. nitida* Müller which is found throughout Europe and Northern Asia.

SEGMENTINA HEMISPHAERULA Benson

Plate 2, figs. 4–5

Planorbis hemisphaerula Benson 1842, Ann. Mag. Nat. Hist., **9**, p. 487 (China: Chusan Island).

Planorbis (Segmentina) calathus Benson 1850, Ann. Mag. Nat. Hist. (2), **5**, p. 348 (Bhimtal, India).

Segmentina lucida Gould 1859, Proc. Boston Soc. Nat. Hist., **7**, p. 41. (Loo Choo).

Segmentina swinhoei H. Adams 1866, Proc. Zool. Soc. London, p. 319, pl. 33, fig. 14-14a (Formosa: Tungkang and Takow).

Planorbis (Segmentina) calathus "Benson" von Martens 1867, Malak. Blätter, **14**, p. 217 (Japan: Yokohama).

Planorbis largillierti "Dunker" von Martens 1867, Malak. Blätter, **14**, p. 217 (Hongkong and Amoy).

Planorbis nitidellus von Martens 1877, Sitzungsber. Ges. Naturf. Freunde Berlin, p. 112. New name *P. calathus* von Martens 1867, not of Benson 1850 (Japan: Yokohama; Muko-Sima; Hakadate).

Planorbis succineus Gredler 1884, Arch. f. Naturg., 50, p. 275 (Hunan Province, China).

Shell in life is colored a glossy reddish brown to light brown. Height of shell is about 3 mm. and the diameter 7 to 9 mm. The internal lamellae are visible from the outside. The umbilicus is very deep. The shell has a "fat" appearance unlike *Hippeutis* species.

This is the species that Barlow collected at Shaoshing, Chekiang Province and found to be harboring cercariae of *Fasciolopsis buski,* although he published it under the name *nitidellus* von Martens. This species is widely distributed throughout Japan, Formosa, and China.

There are slight and insignificant variations occurring throughout its range, the names of which we have included in the synonymy.

Planorbis (*Helicorbis*) *mearnsi* Bartsch has very weak lamellae and appears to be a good species of *Segmentina*. It comes from Mindanao Island, Philippines, but has not been implicated as a disease carrier.

Genus HIPPEUTIS Charpentier 1837

Hippeutis "Agassiz" in Charpentier 1837, Neue Densksch. Allg. Schweiz. Naturw., **1**, no. 2, p. 22. As a subgenus of *Planorbis* (Genotype: designated by Clessin in 1886 *Planorbis complanatus* Drap. (=*Helix fontana* Lightfoot), one of the two species originally included).

Shell similar to *Segmentina* but more flattened, without internal lamellae or calcareous teeth, and generally growing larger (often to 1 cm. in diameter) (See text fig. 14). The shell in life has a very glossy sheen and is very translucent. The animal is very similar to that of the *Segmentina*. It is found abundantly on weeds and grass in ponds and ditches, usually in the presence of smaller *Segmentina*.

HIPPEUTIS UMBILICALIS Benson

Planorbis umbilicalis Benson 1836, Journ. Asiatic Soc. Bengal, **5**, no. 59, p. 741 (India).

Planorbis schmackeri Clessin 1884, Martini-Chemnitz, **1**, 17, p. 211, pl. 32, fig. 4 (Canton).

Hippeutis cantonensis Yen 1939, Abh.Senckenb. Naturf. Ges., Abh. 444, p. 70 pl. 6, fig. 12 (Canton).

This species is possibly an intermediate host of *Paragonimus westermani*. It is found in Formosa, southern China, Indo-China, and India. It is not known from the Yangtze Valley.

The shell of adults is usually 6 to 7 mm. in diameter, and 2 to 2.5 mm. in height. The spire is neatly indented, and the umbilicus narrow but deep. The shell is "fatter" than *cantori* and may be also distinguished from that species by its narrow umbilicus. The color of the shell is glossy, translucent brown. F. C. Baker in 1945 put this species in the subgenus *Helicorbis* Benson.

HIPPEUTIS CANTORI Benson

Plate 2, figs. 2–3

Planorbis cantori Benson 1850, Ann. Mag. Nat. Hist. (2) **5**, p. 349.

Pyramidula (*Patula*) *peipinensis* Ping and Yen 1932, Bull. Fan Memorial Inst. Biol., **3**, p. 25, figs. 1–3. Wrongly interpreted as a land shell.

Hippeutis umbilicalis Benson, T-C Yen, 1939, Abh. Senckenb. Naturf. Ges., Abh. 444, p. 70, pl. 6, fig. 9 (Shoashing).

Hippeutis distinctus Gredler 1886, Mal. Blätter, N. F., **9**, p. 15 (Hunan). Paratype figured by Yen, 1939, loc. supra cit., pl. 6, fig. 10.

This first intermediate host of *Fasciolopsis buski* is abundant in most parts of China, including Shaoshing, Chekiang Province where Barlow did his work on the intestinal fluke.

The shell of adults is the largest *Segmentininae* in China with a diameter of 8 to 10 mm. and a height of only 1 to 2 mm., giving an appearance of being very flat. The spire is slightly concave and the umbilicus very wide but not very deep. The periphery of the last embracing whorl, especially in large specimens is sharp, although it is rounded in a few individuals. The color of the shell is a glossy, translucent brown. F. C. Baker in 1945 put this species in the subgenus *Pingiella* Baker 1945 which is a synonym of *Segnitilia* Cotton and Godfrey 1938.

Subfamily PLANORBINAE H. A. Pilsbry 1934

This subfamily grouping includes a wide variety of planorbid snails, including the genera *Planorbis* Geoffroy 1767, *Anisus* Studer 1820 (Gray 1847), *Gyraulus* Charp. 1837, *Armigerus* Clessin 1884 = *Tropicorbis* Pilsbry and Brown 1914, *Australorbis* Pilsbry 1934 and other less conspicuous genera. In the Asiatic area, *Gyraulus* is commonly found in small, warm bodies of fresh water, but to date no species of this genus have been known to carry the larval forms of human trematodes. They are mentioned here because, in form and size, they are similar to the *Fasciolopsis* carriers, *Segmentina* and *Hippeutis*.

Genus GYRAULUS Charpentier 1887

Gyraulus "Agassiz" Charpentier 1837, Neue Denkschr. Allg. Schweiz. Gesell,. **1**, no. 2, p. 21 (Genotype: *Planorbis albus* Müller (= *P. hispidus* Drap.) subsequently designated by Dall in 1870).

Shell small, of comparatively few flattened whorls, equally visible above and below; the whorls do not envelop the preceding whorls as in the *Segmentininae*; the aperture is nearly round, and not heart-shaped as in the *Segmentininae*. Shell is not highly glossy, and often becomes fouled with vegetative growth. The shape of the tentacles and foot of the animal are very similar to the *Segmentininae*.

Gyraulus is capable of thriving in great numbers in very small, semi-permanent ditches and pools. It is also found in larger, running bodies of water, or in lakes, usually along the grass and reed protected edges. Though often found in company with *Hippeutis*, *Segmentina*, *Oncomelania* and *Viviparus*, very often it is the only genus found in small grassy ditches where the temperature exceeds 90° F.

GYRAULUS CONVEXIUSCULUS Hutton

Text figure 14

Planorbis convexiusculus Hutton 1849, Journ. Asiatic Soc. Bengal, 18, pt. 2, p. 657 (Afghanistan).

This is a very common species with a very wide distribution. It is found throughout India, Indo-China, the East Indies, China, Japan, and the Philippines. This species has been redescribed many times as *compressus* von Martens 1867, *neglectus* Clessin 1884, *demissus* Westerlund 1887, *infralineatus* von Martens 1867, *infracoloratus* (von Martens) Rensch 1934, *javanicus* (Mousson) Neville 1878, *propinquus* (Mousson) von Martens 1867, *sagoensis* Bullen 1906, *compressus* var. *siamensis* von Martens 1867, *confusus* var. *tigrina* Bavay and Dautzenberg 1910, *compressus* var. *striatus* Bollinger 1914, *saigonensis* Crosse and Fischer 1863, *saigonensis* Clessin 1884, *prashadi* Faustino 1933, *mindanensis* Bartsch 1907. It is represented by slight variations in southern China (var. *chinensis* Dunker) and Japan (var. *japonicus* von Martens).

Gyraulus convexiusculus is quite variable even in the same locality, particularly in the contour of the last whorl which may be evenly rounded, more or less compressed or slightly carinated.

A hundred specimens collected at Palo, Leyte, from the same creek bed as *Oncomelania quadrasi* Moellendorff (20% infected with *Schistosoma japonicum*) were crushed with negative results.

Genus AUSTRALORBIS Pilsbry 1934

Members of this genus are the main intermediate hosts for *Schistosoma mansoni* in South America and the West Indies. Though no cases of *S. mansoni* have been known to have been contracted in the Western Pacific — Asiatic regions, the rather recent introduction of a known *mansoni* carrier, *Australorbis glabratus lugubris* Wagner, into the Philippines serves as a potential hazard.

AUSTRALORBIS GLABRATUS LUGUBRIS Wagner

Planorbis lugubris Wagner in Spix, Test. Fluv. Brasil, 1827, p. 27, pl. 18, figs. 3–6 (Ilheos and Almada, Bahia Province, Brasil).

Shell large, sometimes attaining a diameter of over an inch, biconcave, smooth, of slowly widening whorls which are either rounded or slightly angular. The shell is sinistral. Color of animal is gray or black, the mantle is mottled with brown or cinnamon. Tentacles, head and foot not unlike *Segmentininae* and *Gyraulus.*

This species has been introduced to Luzon Island (Lipa, Batangas Province and Manila) in the Philippines, probably from South America. Its spread throughout the Philippines would constitute a serious menace to the health of the populace, since it is known to be a main intermediate host of *Schistosoma mansoni.*

OTHER FRESH-WATER MOLLUSKS

Family PILIDAE

Genus PILA Roding 1798

Pila Röding 1798, Museum Boltenianum, **2**, p. 145 (Genotype: *Helix ampullacea* Linnaeus, as designated by Dall, 1904, Journ. of Conch., **11**, p. 53).
Ampullaria Lamarck 1799, Mém. Soc. Hist. Nat. Paris, p. 76 (Genotype: *Helix ampullacea* Linnaeus).

Pila is a genus of large "apple snails" found commonly in creeks and ponds throughout the Philippines, East Indies and Southern Asia. Members of this genus are noted for the great number and variety of cercarial infections, but as yet no human-affecting trematodes have been found in them. The shell often grows to the size of an orange, is smoothish, sculpture if present being microscopic, and is usually colored a glossy olive brown. The operculum completely closes the aperture; it is very hard, corneous on the outside but calcareous on its inner surface. The muscle-scar of attachment to the foot is prominent, occupying about half the area of the operculum.

The head of the animal has long, tapering tentacles and prominently stalked eyes at their bases. Epipodial lobes, adjacent to the eye stalks, form left (inhalent) and right (exhalent) conduits. The penis arises from the right side of the thick mantle edge and is carried folded back in the cavity.

The animal is amphibious and nocturnal. When it is completely immersed, respiration may be wholly branchial; when out of water, directly pulmonary. The pea-sized globular eggs have a calcareous shell, and are deposited at night in yellowish clusters on the stalks of reeds in shallow creeks.

There are a number of species in the East Indies, Philippines and the Orient, the commonest being *Pila ampullacea* Linnaeus (Plate 2, fig. 8).

Family VIVIPARIDAE

Genus VIVIPARUS Montfort 1810

Viviparus Montfort 1810, Conchyl. System, **2**, p. 246 (Genotype: *Viviparus fluviorum* Montfort = *Helix vivipara* Linnaeus).

This genus is commonly found in lakes and canals throughout the East. There have been many *Cercaria* described from various species of this genus, but none have been known to be of medical importance. The shell is from 1 to 2 inches in length, ovate-conic, with convex or moderately carinate whorls, which may be smooth or variously sculptured; color may be olivaceous, dark brown, or banded. The operculum is nearly circular, corneous, dark chestnut brown, and concentric with the nucleus near the columellar margin.

The tentacles are equal in length in the females, but the right one is often truncate or recurved in the male, where it serves as a penis. The eyes are on low swellings at the posterior bases of the tentacles. There are two cervical lobes, of which the right is the larger and serves as a siphon.

The commonest *Viviparus* throughout China is *V. angularis* Müller 1774 (= *Viviparus quadratus* Benson 1842). See plate 3, fig. 14. *Viviparus japonicus* von Martens 1860 is common in Japan and occasionally found in China. See plate 3, fig. 17.

Family RISSOIDAE

Genus STENOTHYRA Benson 1856

Plate 3, fig. 22

Nematura Benson 1837, Journ. Asiat. Soc. Bengal, **5**, (1836), p. 781 (non Fischer 1812).

Stenothyra Benson 1856, Ann. Mag. Nat. Hist. (2), **17**, p. 342 (Genotype: *Stenothyra deltae* Benson).

This is a genus of small gastropods which are found commonly in brackish water of estuaries in the Pacific-Oriental regions. A few species have become fresh-water in habitat. The snails are very active, but quite timid. In estuaries, they prefer shaded spots under water where there is a bottom of black mud-sand. One species is common in the canals of the Yangtze River Delta in China. No member of this genus has been implicated as a human disease carrier.

The shell is rarely more than 5 mm. in length, is very thick and hard to crush. The small, circular aperture is very characteristic. The shell is grayish in color, ovate in shape, and distinctly compressed in the dorsoventral axis. The operculum is corneous, translucent, paucispiral and with a hard "horse-shoe" ridge on the inside where the muscle of the foot is attached.

The foot of the animal is long, fusiform with the anterior margins extending laterally. At the posterior end on the dorsal side of the foot, there is a small, round filament of flesh. The verge of the male is in the form of a single prong, as in the *Hydrobiinae*, but it has a tiny calcareous spike at the tip. This genus has been put into a subfamily of its own, the *Stenothyrinae*.

Family LYMNAEIDAE

This group of common pond snails is represented by many species in nearly all parts of the world, some of which are known to be the first intermediate hosts of the common cattle liver fluke, *Fasciola hepatica* Linnaeus, a cosmopolitan parasite of sheep, cattle and other ruminants. Only accidental cases have been recorded in man.

LYMNAEA (FOSSARIA) OLLULA Gould

Lymnaea ollula Gould 1859, Proc. Bost. Soc. Nat. Hist., **7**, p. 40 (Hongkong).

Lymnaea pervia von Martens 1866, Ann. Mag. Nat. Hist. (3), **17**, p. 207; 1867, Mal. Blätt., **14**, pp. 221–222.

Limnaeus philippinensis "Mousson" Clessin 1886, Syst. Conch-Cab., **1**, Abt. 17, p. 383, pl. 52, fig. 8 (Philippines).

Throughout China, Japan, Formosa, the Mariana Islands, the Philippines and Hawaiian Islands, *Fasciola gigantica* Cobbold is transmitted by this species. The animal does not possess an operculum. The shell is usually less than half an inch in length, and is quite fragile.

LYMNAEA (RADIX) AURICULARIA Linnaeus

Plate 3, fig. 18

Helix auricularia Linnaeus 1758, Syst. Naturae, 10th edition, Vermes, **3**, Testacea, no. 617, p. 774 (European rivers).

This species is widely distributed over the greater part of Europe, Asia and North America. In western Asia, it is found north of India, throughout China, to Manchuria and Japan. The shell undergoes considerable ecologic variation, and the following forms have been implicated as intermediate hosts of *Fasciola hepatica*: *plicatula* Benson 1842, *japonica* Jay 1856. *Lymnaea swinhoei* H. Adams 1866 appears to be a perfectly good species, but *L. suzuki* Hirase 1932 from Formosa is undoubtedly a synonym of it.

MYXAS CUMINGIANA Pfeiffer

Plate 3, figs. 19–20

Amphipeplea cumingiana Pfeiffer 1845, Proc. Zool. Soc. London, 1845, p. 68 (Nago, Luzon).

Lymnaea (Amphipeplea) luzonica Souleyet 1852, Voy. Bonite, Zool., **2**, p. 525, pl. 29, figs. 33–37 (Manila, Pasig River).

Amphipeplea quadrasi Moellendorff 1895, Nachr. d. Malac. Ges., **27**, p. 119 (Manila).

This species is common in the Philippines. It is found in small, warm bodies of water among grass stems. The animal completely surrounds the shell and is colored either black, gray or light brown. It is of no known medical importance.

Family BULINIDAE (not BULIMIDAE) Germain 1931

This family is closely related to the *Planorbidae*, but is of no known medical importance. The genus *Physastra* is common throughout the

Philippines and East Indies. Other obscure genera are *Ameria, Miratesta* and *Indoplanorbis.* The latter is represented by the species *exustus* Deshayes which is very common in India and Sumatra and the Malay Peninsula and which has been introduced into Hawaii.

Genus PHYSASTRA Tapparone-Canefri 1883

This genus is sometimes considered a subgenus of *Bulinus* Müller. The commonest species in the Philippines is *hungerfordiana* Nevill 1891 and it looks like a "brown, sinistral Lymnaea pond-snail." It is commonly found among the weeds and grass of slowly flowing creeks (Plate 3, fig. 21).

It grows usually to an inch or less in height. No members of this genus in the East Indies or southern Asia have been implicated as disease carriers.

Family POTAMIDIDAE

This is a brackish water group of marine shells that is represented in all tropical and semi-tropical estuarine areas of the world. Two species have been recorded as the first intermediate hosts of *Heterophyes heterophyes* von Siebold. *Pirenella conica* Blainville is limited to the entire Mediterranean Sea and the Red Sea. In Japan, the brackish water snail *Cerithidea cingulata* subspecies *microptera* Kiener has been implicated.

CERITHIDEA CINGULATA MICROPTERA Kiener

Plate 3, figs. 15–16

Cerithium microptera Kiener 1842, Spec. Gen. Iconogr. Coq. Biv., **6**, Cerithium, p. 43, pl. 30, fig. 3 (Ocean Indian).

This is a common brackish water species found in Japanese and Chinese muddy, inter-tidal zones. Adult shells are about an inch in length, turret-shaped, with approximately 12 whorls, and colored a dirty gray. It was originally listed under *Tympanotomus,* a genus of much larger shells limited to Africa, when first implicated as the intermediate host of *Heterophyes heterophyes.* The parent species, *Cerithidea cingulata cingulata* Gmelin 1791 occurs throughout the Indian Ocean, the East Indies and the Philippines, but has not been implicated as yet.

Family NERITIDAE

No members of this family have been known to carry the larval stages of trematodes infecting man. Photographs are given of *Neritina* and *Septaria* which are commonly found in brackish or fresh water in the Pacific Islands and the East Indies (Plate 2, figs. 6 and 7). The operculum is calcareous, paucispiral and its inner edge as a rule has one or two projecting, calcareous, hooks or apophyses; or, in the case of *Septaria,* the operculum is flat, square in shape and buried in the soft parts of the animal.

Family CORBICULIDAE

This is a family of fresh-water clams which is often encountered in the lakes and rivers of China, southern Asia and the East Indies. The genus *Corbicula* is known to act as the second intermediate host of *Echinostoma revolutum* Frohlich in the Celebes. This fresh-water clam is oval in shape, heavy, with each of the two valves lightly tainted with purple on the inside and covered with a tough, thin, greenish epidermis on the outside. The shell is about one to two inches in length. These clams are often used as food by the natives of the East Indies.

Family SPHAERIIDAE

The genus *Sphacrium* has been recorded as one of the second intermediate hosts of *Echinostoma revolutum* Frohlich. This genus is world wide in distribution, and is known commonly as the "fingernail" clam. *Sphaerium* is a fresh-water genus commonly found in the mud bottoms of creeks and ponds. The shells are very small, rarely exceeding a length of one half inch. The valves are very thin, easily crushed, and colored a translucent yellow or white. Records of *Sphaerium* from the Philippines may be young *Corbicula.*

THE POISON CONE SHELLS

Since a number of fatal cone shell bites have been recorded from the Australian and Melanesian regions, we have included a brief discussion of the family *Conidae.* A complete resumé of the subject is given by William J. Clench in Occasional Papers on Mollusks, Vol. 1, no. 7, March 1946, pp. 49–80, pls. 10–14 (Museum of Comparative Zoology, Cambridge 38, Massachusetts), and in a previous report in The American Journal of Tropical Medicine, Vol. 23, no. 1, January, 1943.

The genus *Conus* is represented throughout tropical seas by a great number of species. Five species have been recorded as dangerous, all from the Indo-Pacific region — *C. geographus* Linnaeus, *C. aulicus* Linnaeus, *C. marmoreus* Linnaeus, *C. tulipa* Linnaeus and *C. textilis* Linnaeus. These marine shells are found under rocks and in the crevices of coral reefs and along the rocky shore of protected bays. They are nocturnal in habit, and rather shy by nature. It appears that bites have occurred only while the victim has been holding the living snail in his hands.

The cone shells are predatory animals which prey on other shellfish and suck the juices from the molluscan animals. They are able to do this by means of a long, tubular, fleshy proboscis which can be contracted at will, but when extended reaches beyond the anterior end of the shell. Opening into this tube is a radula-sac containing roughly two rows of numerous, harpoon-shaped teeth. When grabbing its food, or when opposed by any outside agency, such as the hand of a human being, the cone snail immediately shoots out this proboscis and the object is pricked by the sharp points of the teeth. The poison immediately exudes from a special poison gland.

Joyce Allan (The Medical Journal of Australia, Vol. 2, pp. 554–555, 1935) reports that "The symptoms experienced by a person suffering from this shellfish poisoning are, after the first pain of the prick from the sharp pointed teeth, acute pain and considerable swelling, with local numbness which leads to paralysis extending in severe cases throughout the body. In the surrounding tissue the minute points of puncture may be seen. Muscular control goes, and even the head has to be supported in such a way as to allow breathing to continue. Speech becomes thick and indistinct, the throat is considerably affected, the eyesight is dim, and a feeling of 'pins and needles' extends throughout the body. Sore eyes appear to be one of the serious symtoms of the poisoning, and in the case of a European woman who was bitten at Fiji, this was the last to disappear." Deaths have been recorded as occurring four hours after the bite.

Six species of cone shells commonly found in the southwest Pacific area have been illustrated on Plate 5 of this report. Five of these are dangerous, the sixth, *C. striatus* Linnaeus, has not been recorded injurious to man. The nature of the cone shell poison is still unknown.

TECHNIQUES IN HANDLING SCHISTOSOMIASIS SNAILS

Although the few helpful hints given here are the result of eight months of *Oncomelania* collecting in China and the Philippines, future workers will profit by their own improvements as dictated by circumstances. Accounts of the habitats and habits of *Oncomelania* are given under each species in the taxonomic treatment of the medically important gastropods and in the section on Control of the Intermediate Snail Host.

COLLECTING

In the Philippines it was found that the lightest and most usable collecting gear included the following necessary items:

hip rubber boots
dip net
canvas pouch
forceps
magnifier x 10
insect repellant
6 small vials
3 small jars
2 cloth bags
small notebook
pencil and labels
map of area

The danger of coming in contact with waters infected with cercariae is obvious to those who have seen advanced cases of schistosomiasis, and a habit of mental alertness to these hazards must be developed and especial care seen that assistants practice extreme caution.

Although hip rubber boots are hot and cumbersome, they should always be carried along for use in Philippine marshes and creeks where sinkholes and soft mud are unexpectedly encountered. During obviously safe collecting they may be turned down to knee length. The use of rubber gloves is not recommended. With the use of forceps and dip net, it is not necessary to use hands in the water to collect. In addition, rubber gloves are hot, collect perspiration, and create a laxity which results in the wearer unconsciously putting his hands too deeply into the water. A few drops of dimethyl-phthallate (an effective, odorless mosquito repellant) can be rubbed over the hands, and the shirt sleeves rolled down, if collecting is to be done in wet grass after a rain. In case of accidental dunking, the shirt should be wrung out and the exposed skin rubbed free of water droplets. This should be followed immediately by a light application of di-methyl-phthallate

(Scat). In want of this insect repellant, a small bottle of 50% alcohol should be carried for swabbing immediately after an exposure.

Oncomelania can be collected individually with forceps when they are crawling over the moist mud banks, on sticks and coconut husks or collectively with a dip net when the water level of the creek is high. The metal forceps should be from 3 to 6 inches in length and without teeth at the ends. The most effective dip net is about 2 feet in length with the scoop section about 7 inches in diameter and 3 to 5 inches deep. The frame can be made of ¼ inch metal rod to which fine meshed copper screening is soldered for the scoop end, and over which at the other end a comfortable wooden handle (6 inches long, 1½ inches in diameter) may be added. On the average, from 100 to 300 *Oncomelania* can be collected from a colony in an hour's time with forceps. In certain areas of the creek where the water is from 4 to 12 inches deep and the grass from 1 to 2 feet high, the dip net is very effective in striking large colonies. When large quantities and all sizes of *Oncomelania* are required in the laboratory, the simplest method is to spread a cloth sheet the size of a card table on the ground near the bank and on to this knock the contents of the dip net — grass, twigs, mud, and all. In fifteen minutes, from a large colony, several scrapings through the grass in the water will produce 2 to 3 thousand *Oncomelania*. The sheet should be carefully folded and carried to the laboratory where sorting can be done at leisure.

In forcep collecting, *Oncomelania* may be put into pint screw-top jars or in the case of frequent, small samplings, into plastic screw-capped glass vials the size of a man's thumb. These containers may be dry or moist and kept sealed for no longer than 48 hours. Do not fill with water. One of two cotton cloth bags (3-5 lb. salt bag) can be used for larger snails, the *Viviparus*, *Thiara* and *Pila* which, however, should be put into fresh water on returning to the laboratory.

Of paramount importance is the keeping of accurate data as the collections are made in the field. Memory is an unreliable substitute for the small, numbered labels which are easily slipped into the vials. Only one set of consecutive numbers, denoting the collecting localities, should be used for the entire survey or expedition. This information should be kept in a field book with all additional ecologic and geographic notes. These numbers can also be inked in on maps that are in use.

In sending samples to malacologists for identification, the geographic localities should accompany the specimens. Each species to be identified can be labelled with a letter and a duplicate set retained for future reference in correspondence. All *Oncomelania* and at least 3 or 4 specimens in a large series of larger mollusks (*Thiara*, *Viviparus*, etc.) should be sent in 70% alcohol, but never in formaline which eats away the shell. These larger shells can be boiled in water, the animal removed with a bent pin, dried, the operculum and label added, and wrapped in newspaper. A sturdy cardboard carton, rather than a wooden box, is ideal for mailing. Live *Oncomelania* for experimental work are best sent in an absolutely dry condition by courier or air mail. A cardboard packing tube within another tube is satisfactory. Cotton can be stuffed in the end of the first tube. In this way, 90% of 500 snails will arrive safely after three weeks of travel. There are very strict laws against mailing any live snails to, and any disease-carrying snails in, the United States, and permission must be obtained in advance by sending all details to the "Surgeon General of the United States Public Health Service, Washington, D. C." or by having the receiver in the United States obtain this permit for the sender. In any case, the permit must accompany the snails. This does not apply to preserved or cleaned specimens.

CERCARIAL INSPECTION

The most rapid and accurate method of determining the percentage of *Oncomelania* that are infected with the cercariae of *Schistosoma japonicum* Katsurada is by crushing the snails and examining them under a dissecting binocular microscope. Two or three people can set up a simple, assembly-line procedure at the laboratory table. The first person cleans the snails if they are covered with mud by shaking them violently in a jar of water. The snails are placed in a shallow dish from which 4 to 6 specimens are picked up singly with forceps and placed carefully on a clean glass slide. A drop of rain or creek water is put on each snail; down on this a three-quarter length slide is firmly pressed to crush the snails. This unit is passed to the man at the microscope, and another slide prepared for crushing. During the entire operation, it will be found that four pairs of slides will keep each man busy. The man at the microscope inspects each snail, and marks the results on a pad which has the field number and a column for "number positive" and "number negative." After inspection, the scope man picks the slides up at one of their ends, and without letting go, dunks them for a few seconds into a beaker or jar of 5% chloride and water. The clean slides are then tossed on to a folded towel in front of the third man. In the meanwhile another slide of crushed snails has been prepared and set on the microscope platform for his inspection. The third man receives wet slides from the towel, dries them with cheese-cloth or gauze and then passes them to the first man for re-use. The gauze becomes too damp for use in ten or fifteen minutes.

Infected specimens are usually easy to spot. The brownish liver of the snail is usually small or nearly absent and in its place are the whitish globular or elongate sporocysts. These are nearly always ruptured and dozens, sometimes hundreds, of silvery white, quivering fork-tailed cercariae can be seen in the water just beside the apex of the crushed snail (See plate 2, fig. 1).

In China, *Oncomelania hupensis* Gredler are more difficult to crush and usually only 3 or 4 specimens can be handled between a pair of slides. *O. nosophora* Robson is not much stronger than the Philippine *O. quadrasi* Moellendorff, but because of their size fewer can be crushed at one time.

Sometimes because of the nature of the experiment, cercariae must be obtained or the snails inspected without crushing. If *O. quadrasi* Moellendorff are to be individually inspected, they should be kept during the day separately in miniature terrariums. For this purpose a small medicine glass or glass vial (2 inches high, 1 inch diameter) is half filled with earth, over which is lightly packed, a quarter or half inch layer of decaying and fresh vegetation (moss, leaves, grass, etc.). The terrarium must be kept moist but not wet; and the snail is prevented from crawling out by a piece of gauze held over the top by an elastic band or string. *O. quadrasi* shed cercariae most frequently between 9 and 12 at night. The snail should be put into a small tube about the size of a man's thumb. Creek or rain water with an exact pH of 7.6 is added until the surface of the water is 2 mm. from the top. A slide is put over the mouth of the tube. In this way, there is air for the snail, and yet the snail is forced to remain at least partially in the water where it can shed cercariae. On an average, infected snails will shed about 100 cercariae in a night, although 1500 have been recorded for one individual. Snails may be inspected several days after collecting. If the water type inspection is made for three consecutive nights, the snails should be given a few days rest, as shedding decreases materially on the fourth night.

LABORATORY REARING

The problem of rearing *Oncomelania* in the laboratory is one which has not yet been solved, and in the meantime it is advisable to follow the ancient method of attempting to duplicate conditions found in nature. It is suggested that a large low, glass culture dish with straight sides (four inches high, 12 inches in diameter) be used, with a similarly-shaped and smaller semi-porous flower pot set in the center (2 inches high, 7 inches in diameter with a hole punched in the bottom). Between the two containers and at the level of the inner pot, loose earth and heavy moss should be packed. A few dead leaves and one or two water-logged twigs should be placed with the snails in the center pot. The water level should be kept one inch above the bottom of the inner container and the moss and earth kept damp. To prevent the snails from crawling out of the second container an inch-wide collar of stiff paper should be taped to the glass edge. A terrarium of this size should be allowed to support not more than 100 specimens. The pH should range between 6.8 to 7.8. The most natural temperature of the water for *O. quadrasi* is 75° to 80° F. Chinese and Japanese *Oncomelania* will do best in water from 60° to 75° F. Aquaria should not be put in direct sunlight, nor should the temperature be allowed to rise above 89° F.

In China and the Philippines where these containers are sometimes difficult or too expensive to obtain, the ever-present oil drum can be cut in two longitudinally, painted white inside, and set on wooden cross-piece stands. Clods of grass and earth may be removed from the creek or canal banks and set in these oil-drum tanks and kept moist. In this way a handy reserve of snails is always in the laboratory.

Large, straight-sided fish aquaria are not suitable for *Oncomelania.* Invariably, the snails will crawl out of the water and attach themselves to the glass sides. Unless mechanically knocked back into the water, these aestivating snails will remain there until they die.

CONTROL OF THE INTERMEDIATE SNAIL HOST

Of the six most important helminthic diseases of the East, caused by *Clonorchis, Paragonimus, Metagonimus, Fasciolopsis, Fasciola,* and *Schistosoma,* only control of the last two appears to be necessary or feasible through snail extermination. The first four have a distribution and prevalence that is governed by the eating customs of the people. The *Buliminae* (hosts of *Clonorchis*) and *Thiaridae* (hosts of *Paragonimus*) are very common and well established in either large ponds or sizable rivers in endemic areas, and use of chemicals would not only be prohibitive in cost but, even if applied in effective enough quantities, would in all likelihood be a serious detriment to the local fishing of the natives. Should a specific chemical control be found for the *Clonorchis*-carrying *Bulininae*, the wisdom of its liberal use in fish ponds must be weighed against the value of the snails as a fish food. The educational approach, no matter how long or difficult, with its ultimate result of disease elimination through properly cooked fish and crabs seems the most promising. Fasciolopsiasis, though ostensibly not as alarming a disease as the others, affects the community health in general, as in the case of the large area just south of Hangchow, Chekiang Province, China; but again, snail control is hardly feasible or even advisable. A long, patient educational program against the custom of eating or peeling with the teeth the raw caltrop nuts promises the best results in the final analysis.

Fasciola affects man only indirectly, but often quite forcibly, in its attack on cattle and sheep. This problem is only of importance to peoples who have included the ruminants in their food economy. The intermediate host, *Lymnaea* (*Fossaria*) *ollula* Gould, found throughout the Philippines, most of the Western Pacific Islands of volcanic origin, and the southern coast of China, does most of its damage in the wet and soggy areas of pastures, which border permanent creeks or lakes. Removal of cattle to higher and drier land until the snail can be chemically eliminated during a treatment period of a week seems to be feasible from the point of view of labor, cost and safety. In England, the use of copper sulfate has been advocated against *Lymnaea truncatula* Müller. The chemical may be dusted, broadcast or sprayed in a two, one or one-half per cent solution. Where the herbage becomes covered with the mixture in spraying, animals should be kept off treated areas until the spray has been washed away by rain. Chandler (1920), experimenting in Oregon and Texas with eight species of snails, belonging to six families, found that one part of copper sulfate to from 500,000 to 2,000,000 parts of water, destroyed most of them within 48 hours. In the Philippines and Pacific Islands such as Guam and Saipan where cattle herds are being introduced, it is often impossible to consider spraying large tracts of swamp land where cattle are sometimes allowed to wander. If sufficient hilly or dry land is available, it is advisable to fence off the swamp areas and put in water troughs at one end of the high range. Copper sulfate is not likely to be effective against the operculate snails (*Amnicolidae* and *Thiaridae*) and especially not in cool, running brooks.

The artificial application of drought, such as ditch or pond draining, is not likely to be effective. In tropical countries with high atmospheric humidity, even the *Lymnaeidae* and *Planorbidae* may well be able to withstand weeks of drought. Most of these mollusks, when completely eliminated, have an uncanny way of being re-introduced from other areas.

Oddly enough, schistosomiasis, the helminthic disease with the severest symptoms and the most easily acquired must by necessity, and can more easily, be controlled by the elimination of the snail host. There is no second intermediate host involved, and since the living habits of the people in endemic areas are so intimately associated with infected waters, no amount of education will develop a discipline of habits strong enough to check the disease. In China and the Philippines, promiscuous defecation, the presence of reservoir hosts, and the use of human feces for fertilizer make sanitary fecal disposal very difficult.

The control of schistosomiasis involves the elimination of *Oncomelania* snails. No widespread attempt should be made, for the task of eliminating a species in nature would call for more material, labor and time than is available. Instead, the snail colonies which prove to be contributing most to the spread of the disease in certain villages or barrios should be attacked first. This calls for accurate recognition of the guilty species of snail, a thorough survey to mark out the limits of distribution of the *Oncomelania* colonies in the endemic area, and the application of control measures, including the dispersal of an effective chemical agent.

Recognition of *Oncomelania* snails is covered in the taxonomic account at the beginning of this paper. The problem of locating the boundaries of an Oncomelania colony is entirely different in the Philippines and China. Throughout certain areas on the islands of Leyte, Samar, Mindoro and Mindanao there are complicated series of creeks and marshes, many of which are difficult to reach. Only a few of these may present conditions suitable for the existence of *Oncomelania quadrasi* Moellendorff and there is no way, so far as we know, in which the presence of the snail can be predicted on the basis of ecologic or topographic observations. Man and domestic animals, because they are not always indigenous to the area in which they are found, cannot be used as an absolute index of the infectivity of given bodies of water. With the abrupt dispossession of homes due to the war, the population of many sections in the Philippines has undergone a great deal of displacement. This is also true in China where mass migrations took place to and from endemic areas during the war.

The work of T. B. Magath and D. R. Mathieson on Leyte (NAMRU-2) has shown that the wild rat may serve as a useful index in determining areas in which the life history of the trematode is being completed. In tropic countries where rats are continually foraging in the undergrowth and are exposing themselves to infective waters, danger areas where the snail exists can be quickly located by trapping and examining rats. It was found that wild rats on Leyte Island do not migrate normally more than a quarter of a mile. Spring traps baited with fresh pieces of coconut were set late in the afternoon in the tall grass and underbrush in the immediate vicinity of the creeks. The traps were collected the next morning, and a 30% "catch" was considered satisfactory. Loss of traps was cut down by mapping the locations at the time of setting. In the laboratory, small pieces of rat liver and spleen were pressed out between slides and examined under the microscope for the presence of *S. japonicum.* When ova were found in the liver (infested rats never failed to have eggs in the posterior central lobe), a search under a binocular dissecting microscope was made of the mesenteric vessels for the presence of adult worms. The liver usually exhibits a high degree of portal cirrhosis and grossly visible accumulations of eggs and pigment. There is a strong suggestion, from the 163 rats examined, that this animal is a blind, reservoir host and does not contribute to the spread of this disease to any significant degree.

Through rat examination and subsequent snail collecting, the body of water responsible for the disease can be located and mapped out. Control measures in the form of education, privy construction, elimination or penning of domestic reservoir hosts are not within the scope of this paper. If a serious attempt to eliminate the snail is to be made, the aid of local inhabitants should be enlisted to clear away the underbrush along the edges of the creek. The purpose is to eliminate as much protective shade as possible and to make easier the application of chemicals. This plan cannot be carried out in many instances, but special efforts should be made in localities where the local inhabitants wash their dishes and clothing. In the Philippines, secondary infective localities, often several miles from the barrio, where natives stop by the road to wash or cool their feet in the creek, should be located and treated.

The last word on chemical control has by no means been written, and research is still being carried on by many agencies. Among the several chemicals tested on *Oncomelania* by the Army Schistosomiasis Commission on Leyte (D. McMullen), the most effective were copper sulfate, calcium cyanimide, and DHPC or dinitro-cyclohexal-phenol (Dow Chemical Company). The last two in dust form were not harmful to grass or fish, though their toxicity to man is unknown so far. Tests were made by us on the eggs of *Oncomelania*, and the following chemicals even in the form of heavily applied dust were ineffective: Paris green, copper carbonate, copper sulfate, calcium arsenate, and calcium cyanimide. However, DCHP in relatively small quantities was found to have a triple action, killing the snail, its egg and the cercariae of *S. japonicum* (5 ppm in 12 hours). Of importance is the fact that this chemical in small, fatal amounts acts as a "narcotic" causing the *Oncomelania* snail to relax and extend itself. Most other toxic compounds, even in minute quantities, cause the snail to withdraw into its shell and seal itself off with the operculum. This protective withdrawal in many cases may last for days until rains or currents of water have washed away the poisonous material. DCHP does not "narcotize" *Thiara* or *Viviparus* snails. This specificity of the narcotic effects of DCHP on *Oncomelania* is duplicated in the case of menthol crystals which were used on *Oncomelania* for malacological study in the laboratory.

Unslaked lime which will kill snails is not recommended because of its harmful effects to grass, cattle, fish and bathers. The suggestion (Bartsch 1936) that crushed limestone be used to eliminate *Oncomelania* is not practical, since *Oncomelania* can thrive in alkaline water (pH 7.8), and prefer waters which have a high calcium carbonate availability.

In contrast to the situation in the Philippines described above, in the Yangtze River delta of China where *Oncomelania hupensis* Gredler is responsible for the spread of schistosomiasis, the snails can be located fairly easily. Apparently, rats cannot be used as an index because of their low rate of infection even in highly endemic areas. Food and protection seem to keep the rats close to the houses. In most instances the canal banks are even, devoid of shrubbery and easily accessible. Application of chemical dust is recommended late in the autumn when the dead grass and reeds can be first burned away and when the canal waters are low. Early spring is the next best time. Dusting can be done with a hand-crank machine preferable from a boat or from the banks themselves. Attention should be given to small moist ditches running into the canal, for *Oncomelania* often work their way up these places during the summer.

In the hilly regions of China, the problem of snail control is more difficult, and conditions are sometimes similar to those found in the Philippines. *Oncomelania nosophora* Robson are found in small or large colonies which have an exceedingly spotty distribution in the small runs of water in mountain valleys. Frequently, colonies extend from the deep ditches into the inner edges of rice fields. A preliminary survey with the use of colored markers should be made. Again, late autumn would present the optimum chances of locating *Oncomelania* and best conditions for chemical dusting. In using local labor to locate colonies, a check should be made to see that *Syncera* colonies have not been mistaken for *Oncomelania* (See text figs. 6 and 11).

APPENDIX A

GENERIC DISCUSSION OF *SCHISTOSOMOPHORA*, *KATAYAMA* AND *ONCOMELANIA*

Recently there has been a difference of opinion as to the validity of two schistosome-carrying genera, *Katayama* Robson and *Schistosomophora* Bartsch. After considerable study of living material, we believe that *Schistosomophora* is a synonym of *Katayama*, and that *Katayama* is so close to *Oncomelania* that, at best, it can only be considered of subgeneric rank. From malacological evidence alone, we feel obliged to put all the known Oriental intermediate hosts of *Schistosoma japonicum* Katsurada in the genus *Oncomelania* Gredler.

The characters used for the recognition of the genus *Schistosomophora* have been shell shape, the denticle counts on the rachidian tooth of the radula, and the number of whorls in the operculum. *S. hydrobiopis* Rensch was shown to be a synonym of *quadrasi* Moellendorff first by Rensch himself in 1933, Bequaert in 1934, Abbott in 1945, and Bartsch in 1946.

Shape of shell: When large lots of the Philippine species, *quadrasi*, are compared with the Japanese and Chinese species, *nosophora*, and the Formosan, *formosana*, it will be seen that all three are the same in shell thickness, texture, growth lines and color. However, there is shell-shape which is characteristic of each species. This shape is the result of the proportionate size of the body whorl to the rest of the whorls in the spire. In *quadrasi*, the body whorl is proportionately quite large; thus giving the shell a fat appearance. In *nosophora*, the body whorl is proportionately small, thus giving the shell an elongate shape. In Formosa, we have a species whose shape is intermediate between *nosophora* and *quadrasi*. Moreover, there are 5% Formosan specimens in a series of 500 shells which are indistinguishable from *quadrasi*, and approximately 10% which are the same shape and size of many *nosophora* specimens, from Japan and China. We cannot believe that the shell shape in this case is of generic value since degrees of this character are common to species considered by Bartsch as belonging to *Katayama* and *Schistosomophora.* Very recently (1946) Bartsch has nullified the value of shell shape by his description of *Schistosomophora robertsoni* from China which has a shape identical to that of many specimens of *nosophora* from Japan.

The operculum: The characters of the opercula were offered in a key and in clear drawings by Bartsch (1936) as follows: *Schistosomophora* —— 1.5 whorls; in all six species of *Katayama* —— 3.2 whorls; in all seven species of *Oncomelania* —— 2.2 whorls. In our work, a careful microscopic examination of the nucleus of the opercula of newly hatched *quadrasi* and *O. hupensis* and very young *nosophora* showed that there is no whorling in the center, and that actual whorls are only formed after the snail hatches. Therefore, as growth of the animal occurs, the whorls of the opercula will be in proportion to the number of shell whorls, a character which is common to these three genera. It is common knowledge among workers in Japan and China that no difference can be seen, even in fresh material, in the opercular whorls of adults. We agree entirely with these workers, and feel that Bartsch's differences are exaggerated.

The rachidian tooth: The number of cusps on the anterior edge of the tooth and the number of small basal denticles have been used to separate the three genera. Bartsch gives *Schistosomophora* $\frac{2\text{-}1\text{-}2;}{2\text{-}2}$ and *Katayama* $\frac{1\text{-}1\text{-}1.}{3\text{-}3}$ The first discrepancy is found in Robson's original description of *Katayama nosophora* which included the count of $\frac{2\text{-}1\text{-}2}{3\text{-}3}$ We made a number of radulae mounts from living *K. nosophora* from the type locality, Katayama, Japan, and found that both Bartsch and Robson are correct. In fact, we found enough variation (from specimen to specimen and within the same radular ribbon) to show that the denticle counts could not possibly be used to separate even species. This is true of the Philippine species, *quadrasi,* which has varying counts of $\frac{2\text{-}1\text{-}2,\ 1\text{-}1\text{-}1,\ 1\text{-}1\text{-}1.}{3\text{-}3 \quad 3\text{-}3 \quad 2\text{-}2}$ This was found true also of *Oncomelania hupensis,* all from the same colony in a Chinese canal, in which the counts of unworn teeth were $\frac{1\text{-}1\text{-}1,\ 1\text{-}1\text{-}1,\ 2\text{-}1\text{-}2.}{3\text{-}3 \quad 2\text{-}2 \quad 2\text{-}2}$ We found that in some specimens the rachidian count was constantly of one type, and that in others there were other types or combinations of several types. Our work was done as carefully as possible in water mounts. Other workers in China and Japan have published similar observations on the radulae of this group, and it is satisfying to know that our results coincide with theirs. Parasitologists will have no need to make radular inspections in this group for species identifications, since variation, genetic and ecologic (wearing), renders these characters useless in generic and specific identification. This is not necessarily true for other families or groups of mollusks.

F. C. Li published in 1934 an excellent account of the variation of the shells of *Oncomelania hupensis* in the flat plains of the Yangtze and the hilly regions which border the mountains in Chekiang Province. Our work in China took us over the same areas where we found that Li's observations were quite correct. Until one has collected *Oncomelania* in the field, there can be no full appreciation of the amazing amount of variation that is brought about by the surroundings. In the Hangchow, Chekiang Province area, we found in the canals two miles northeast of the city, large, heavily ribbed individuals such as are found in the Shanghai area. A mile nearer the hills and in the same canal system we found colonies of moderately ribbed shells. A few of these were heavily ribbed and a few with the last whorl almost smooth. In the canal farther west and next to the hill where a brook entered, we found a predominence of very weak-ribbed individuals. Some of these we found in copula with several rather strongly ribbed shells. Collecting in an area of a few dozen feet we were able to find shells which fit the descriptions of several of Heude's and Bartsch's "species."

Near a shrine we found a small colony under adverse conditions in which the shells were all nearly smooth. A hundred yards away, and separated by a moat, we located a large colony of "*Katayama*." All these shells were smooth, but these, however, were a different species —— the shells were all one to two mm. shorter in length and the animals were a dark gray black in contrast to the yellowish light brown of *O. hupensis* across the moat. In *hupensis* the nuclear whorls are tinged with pink in many individuals, clear in others. The percentage of shells with pink nuclear whorls varies from 50 to 100 (the latter case named *yaoi* by Bartsch). In the "*Katayama*," the nuclear whorls are always clear or slightly tinged with tan. A reddish purple color will be present on the spire, however, if the nuclear whorls have been corroded.

Since the author and F. C. Li can find no difference in the external or internal anatomy of *Oncomelania hupensis* and "*Katayama*" *nosophora*, and since the strength of the ribs in *hupensis* varies from very stout to almost obsolete, we consider these two species as belonging to the same genus. In addition, the habits, eggs and egg-laying habits of the two species are the same. We have shown previously that there is no generic difference in the radular and opercular characters.

We can find no important difference in the shells of the Japanese and Chinese specimens of "*Katayama,*" other than ecologic, and we are therefore considering all known Japanese and Chinese colonies as *Oncomelania nosophora* Robson. There are several other fresh-water mollusks in the Orient which have a similarly wide distribution, for example *Parafossarulus manchouricus* and *Semisulcospira libertina.* This wide distribution is also found in the case of the North American snail, *Pomatiopsis lapidaria* Say, which is remarkably close to *Oncomelania nosophora* in size, morphology, and amphibious habits.

Oncomelania hupensis is limited to the Yangtze River drainage, and is variable in shell and rib thickness depending upon whether the snail lives in the quiet, warm waters of the canals where calcium and nitrogen contents are high or in the cool, clearer waters of canals bordering the hill regions. The combinations of number and thickness of ribs, contour of whorls, length of shell and percentage of pink nuclear whorls in these snails found throughout the Yangtze system are infinite, and continued recognition of these variations as specific characters will lead to a new species for nearly every locality which presents slightly different ecologic conditions. Where a river is continually overflowing, changing its course throughout the ages, and is inter-connected with thousands of miles of canals, we can expect a uniformity in the distribution of fresh-water species. *Parafossarulus eximius* Frauenfeld, *P. manchouricus*, *Alocinma longicornis* Benson, *Bulimus fuchsianus* Moellendorff, *Viviparus angularis* Müller, and *Oncomelania hupensis* Gredler have a wide distribution throughout the Yangtze system, and all but two of these extend into many other river systems north and south.

APPENDIX B

REVISION OF MOLLUSCAN NAMES APPEARING IN PARASITOLOGY TEXTBOOKS

In order to standardize the names of the intermediate snail hosts that have appeared in several textbooks dealing with Trematoda, the following list of names is brought up to date in accordance with the more recent findings of several workers. Many groups of mollusks, particularly the *Lymnaeidae* and *Thiaridae*, are still in a state of flux, and until larger collections are made and the literature more thoroughly searched, these names are likely to undergo further changes. This list deals only with the medically important mollusks of the Pacific-Oriental regions. The number in parenthesis after the molluscan name refers to one of the following textbooks or articles: (1) Faust, E. C., 1922, Parasitology, **14**, p. 263; (2) Belding, D. L., 1942, Textbook of Clinical Parasitology; (3) Bercovitz, Z. T., 1944, Clinical Tropical Medicine; (4) Stitt, Clough and Clough, 9th ed., 1938, Practical Bacteriology, Haematology, Parasitology; (5) Faust, E. C., Khaw, O. K., etc., 1927, Studies on *Clonorchis sinensis* Cobbold, Amer. Journ. Hyg. Mono. ser. 8; (6) Mackie, Hunter and Worth, 1945, A Manual of Tropical Medicine, pp. 374, 403, 411; (7) Faust, E. C., 1939, Human Helminthology, 2nd edition.

It will be noted that the author of a species has been given in full after each name. This is as much a part of the name as the genus and species, and should be quoted in textbooks or reports as such. Many identical names have been applied, through error, to unrelated species, and unless the author's name is given, the snail's identity in many cases will remain uncertain. Throughout the text of this handbook, date of description has appeared after the author's name, but these are merely a bibliographic aid for malacologists and need not be given in parasitology works.

Alocimua (6) = misspelling for *Alocinma*.

Ampullaria (7) = *Pila*.

Aspidobranchia (7) = *Scutibranchiata*.

Assimenea lutea (3) = *Syncera lutea* A. Adams.

Bithynia (4, 5, 7) = *Bulimus; Bithynia fuchsiana* (3, 7) = *Bulimus fuchsianus* Moellendorff; *Bithynia longicornis* (3) = *Alocinma longicornis* Benson.

Blanfordia (*Oncomelania*) *formosana* (2) = *Oncomelania formosana* Pilsbry and Hirase; *Blanfordia* (*Oncomelania*) *nosophora* (2) = *Oncomelania nosophora* Robson; *Blanfordia quadrasi* (3) = *Oncomelania quadrasi* Moellendorff.

Brotia (*Melania*) *ebenina* (implicated by Faust) (2) = *Semisulcospira libertina* Gould; *Brotia gottschei* and *nodiperda* (2) = *Hua amurensis* Gerstfeldt; *Brotia libertina* (2) = *Semisulcospira libertina* Gould; *Brotia paucicincta* (2) = young *Semisulcospira libertina* Gould; *Brotia extensa* (2) = *Semisculcospira libertina extensa* von Martens; *Brotia obliquegranosa* (2) = *Thiara* (*Tarebia*) *granifera* Lamarck.

Bulimus longicornis (2, 7) = *Alocinma longicornis* Benson.

Galba (7) = *Lymnaea* (subgenus *Fossaria*).

Gyraulus prashadi (2), *saigonensis* (3) and *sainogensis* (misspelling) (6) = *Gyraulus convexiusculus* Hutton.

Hemibia hupensis (2) = *Oncomelania hupensis* Gredler; *Hemibia quadrasi* (2) = *Oncomelania quadrasi* Moellendorff.

Hua paucicincta (6) = young of *Semisulcospira libertina* Gould.

Katayama (3, 4, 6, 7) = *Oncomelania; Katayama nosophora* (3, 4, 6, 7) = *Oncomelania nosophora* Robson; *Katayama formosana* (3, 6) = *Oncomelania formosana* Pilsbry and Hirase; *Katayama n. yoshidae, lii, fausti, cantoni, tangi* (6) = races and ecologic forms of *Oncomelania nosophora* Robson.

Lymnaea pervia (2, 7) = *Lymnaea* (*Fossaria*) *ollula* Gould.

Melania (*Sulcospira*) (7) = *Semisulcospira; Melania libertina* (3, 4) = *Semisulcospira libertina* Gould; *Melaniidae* (7) = *Thiaridae*.

Melanoides multicinota (6) = *Semisulcospira libertina multicincta* von Martens; *Melanoides ningpoensis* (6) = *Hua* (*Namrutua*) *ningpoensis* Lea.

Oncomelania hydrobiopsis (syn. *Blanfordia quadrasi*) (4, 7) = *Oncomelania quadrasi* Moellendorff; *Oncomelania moellendorffi, longiscata, elongata, schamackeri* (misspelling for *schmackeri*), *multicosta, costulata, crassa, yaoi* (6) = races and ecologic forms of *Oncomelania hupensis* Gredler.

Parafossarulus striatulus (2, 3, 7) = *Parafossarulus manchouricus* Bourguignat; *Parafossarulus sinensis* (3) = not implicated to our knowledge.

Planorbis caenosus (3) misspelling and *Planorbis coenosus* (2) = specimens implicated in Formosa which were probably *Hippeutis cantori* Benson.

Schistosomophora (4, 6) = *Oncomelania; Schistosomophora quadrasi* and *hydrobiopsis* (6) = *Oncomelania quadrasi* Moellendorff.

Segmentina. There has been great confusion in misidentifications and synonyms of this genus. The specimens that Barlow implicated were *Segmentina hemisphaerula* Benson and *Hippeutis cantori* Benson. *Segmentina schamackeri* (6) = *Hippeutis cantori* Benson; Faust's *Segmentina succinea* Gredler (1) were probably young *S. hemisphaerula* Benson.

Tarebia obliquegranosa (6) = *Thiara* (*Tarebia*) *granifera* Lamarck.

Tympanotomus microptera (2) = *Cerithidea cingulata microptera* Kiener.

Viviparus eximineus Frfld. misspelling for *eximius* Frfld. (1) = *Parafossarulus eximius* Frauenfeld.

Wanga gottschei and *nodiperda* (6) = *Hua amurensis* Gerstfeldt.

BIBLIOGRAPHY OF *ONCOMELANIA*

ABBOTT, R. T.

1945. The Philippine intermediate Snail Host (*Schistosomophora quadrasi*) of Schistosomiasis. Occasional Papers on Mollusks, **1**, no. 2, pp. 5–16, 5 plates, Harvard College.

1946. The Egg and Breeding Habits of *Oncomelania quadrasi* Moellendorff, the Schistosomiasis Snail of the Philippines. Occasional Papers on Mollusks, **1**, no. 6, pp. 41–48, 1 plate, Harvard College.

ANNANDALE, N.

1924. The Molluscan Hosts of the Human Blood Fluke in China and Japan. American Jour. Hyg., mono. ser. 3, pp. 269–294, plate 36.

AVERY, JOHN LAWRENCE

1946. The Habitat of the Snail Host of *Schistosoma japonicum* in the Philippines. Science, **104**, no. 2688, p. 5, July, 1946.

BARTSCH, P.

1936. Molluscan Intermediate Hosts of the Asiatic Blood Fluke, *Schistosoma japonicum*, and Species Confused with them. Smithsonian Misc. Coll., **95**, no. 5, pp. 1–60, 8 plates.

1936. A New Intermediate Host of the Asiatic Blood Fluke, *Schistosoma japonicum*. [*Katayama tangi*] Proc. Biol. Soc. Washington, **49**, pp. 139–142.

1939. A New Intermediate Host of the Asiatic Blood Fluke, *Schistosoma japonicum* Katsurata. [*Oncomelania yaoi*] Journ. Washington Acad. Sci., **29**, pp. 173–174, figs. 1–2.

1946. *Schistosomophora* in China, with Descriptions of Two New Species and a Note on Their Philippine Relative. Smithsonian Misc. Coll., **104**, no. 20, pp. 1–7, 1 plate.

BEQUAERT, J.

1934. The molluscan Intermediate Host of the Blood Fluke, *Schistosoma japonicum* Katsurada, in the Philippines. The Journ. of Parasit., no. 5, pp. 280–282.

LI, FU-CHING

1934. Anatomie, Entwicklungsgeschichte, Oecologie und Rassenbestimmung von *Oncomelania* . . . in China. Trans. Sci. Soc. China, **8**, pp. 104–145, 36 figures.

1935. Beobachtung über die Embryonale Entwicklung von Einigen Susswasserschnecken. The Chinese Journal of Zoology, **1**, pp. 117–124, 9 figures.

HUKUDA, MASUGI

1938. Classification of Japanese Species of *Katayama* (Gastropoda). Venus, **8**, pp. 147–154. Figures.

McMullen, D. B. and O. H. Graham
1947. Studies on the control of *Oncomelania quadrasi*, the Molluscan Intermediate Host of *Schistosoma japonicum* in the Philippine Islands. Amer. Journ. Hygiene, **45**, no. 3. pp. 274–293.

McMullen, D. B.
1947. Observations on the Habits, Ecology and Life Cycle of *Oncomelania quadrasi*, the Molluscan Intermediate Host of *Schistosoma japonicum* in the Philippine Islands. Amer. Journ. of Hygiene, **45**, no. 3, pp. 259–273.

Rensch, B.
1933. Bericht über "Eine neue Hydrobiidae von den Philippinen." Philippine Journ. Sci., **50**, p. 325.

Sugiura, S.
1933. Studies on Biology of *Oncomelania nosophora* (Robson), an Intermediate Host of *Schistosomum japonicum*. Mitt. a. d. Pathol. Inst. Med. Fakul. Niigata, Japan. no. 31, **18**, 18 pp., 3 plates.

Sumpaico, Joaquin
1941. Developmental stages of "Blanfordia quadrasi". Monthly Bulletin Bureau Health Commonwealth of The Philippines, **21**, no. 6, June, pp. 299–300, 1 plate, 6 figs.

Tubangui, M. A.
1932. The molluscan intermediate host in the Philippines of the oriental blood fluke, *Schistosoma japonicum*, Phil. Journ. Sci., **49**, pp. 295–304.

Tubangui, M. A. and A. M. Pasco
1941. Studies on the geographical distribution, incidence, and control of schistosomiasis japonica in the Philippines. Phil. Journ. Sci., **74**, pp. 301–327.

Wu, Kwang
1938. Schistosomiasis in the Shanghai Hills Region. The China Journal, **28**, no. 3, pp. 133–139, 13 figs.

PLATES

PLATE 1

PLATE 1

Fig. 1. The shells of two species of *Oncomelania* which serve as the intermediate snail hosts of *Schistosoma japonicum*, the Oriental Blood Fluke disease. (A). *Oncomelania nosophora* Robson found in Japan and many parts of China. (B). *Oncomelania quadrasi* Moellendroff found on several of the Philippine Islands.

Figs. 2–4. *Oncomelania nosophora* Robson. (x 2)

Figs. 5–6. *Oncomelania quadrasi* Moellendorff. (x 2½)

Figs. 7–9. *Oncomelania hupensis* Gredler. (x 2) Hangchow, Chekiang Province, China. Note the variation in shape and length of shell and the strength of ribs.

Fig. 10. *Blanfordia japonica* A. Adams. This genus is known only from Japan. Note the fewer and more globose whorls than in *Oncomelania*. See drawings of animals p. 282.

Figs. 11–13. *Syncera pseudoquadrasi* new species (x 3). Note resemblance to *O. quadrasi* (figs. 5–6). See drawings of animals p. 260. (Paratypes in M.C.Z. no. 175326).

Fig. 14. *Syncera colombeliana* Heude. (x 3). Frequently found in company with *Oncomelania nosophora* Robson in China.

Fig. 15. *Parafossarulus eximius* Frauenfeld. (slightly reduced).

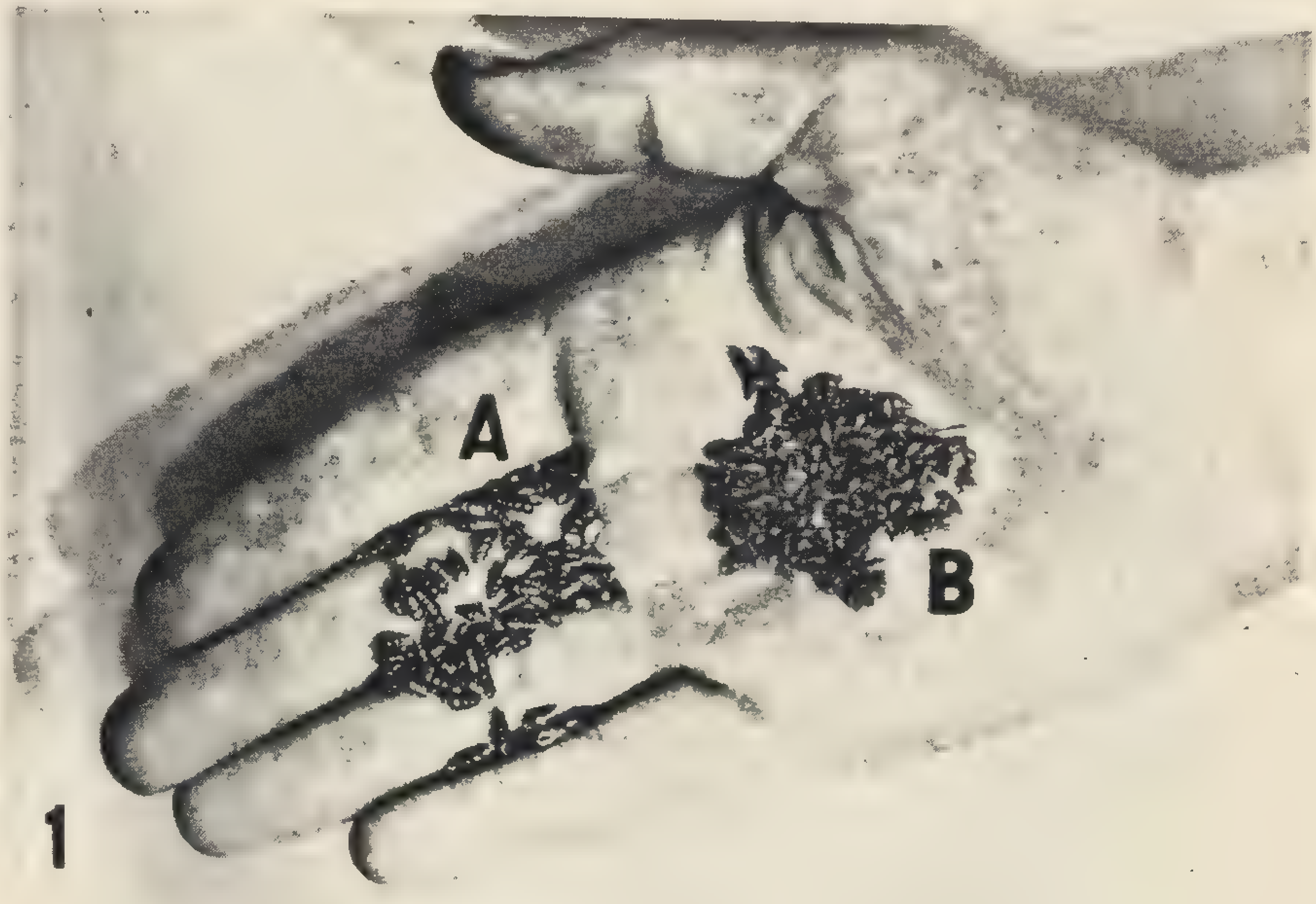
Fig. 16. *Bulimus misellus* Gredler (x 3).

Fig. 17. *Parafossarulus manchouricus* Bourguignat (x 2).

Fig. 18. *Parafossarulus sinensis* Neumayr. (x 3).

Fig. 19. *Bulimus fuchsianus* Moellendorff.

Fig. 20. *Alocinma longicornis* Benson (x2). See text figures, pp. 274, 275, 280.



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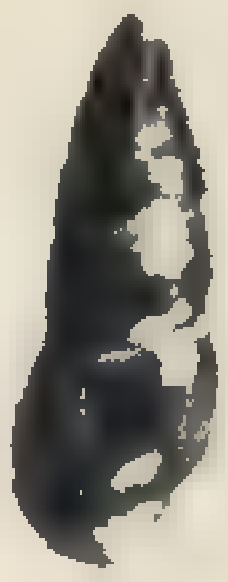
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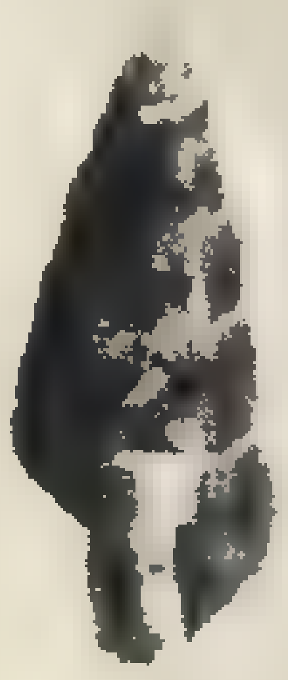
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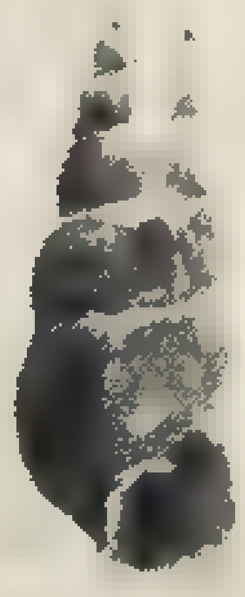
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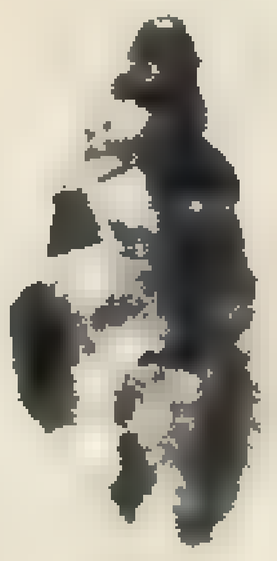
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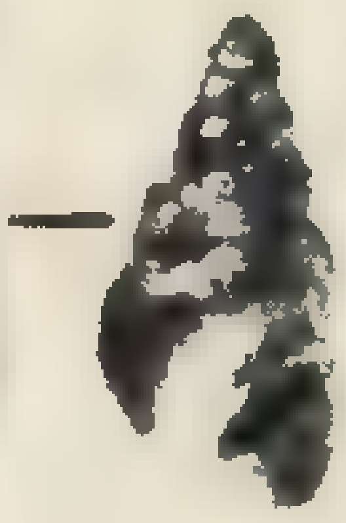
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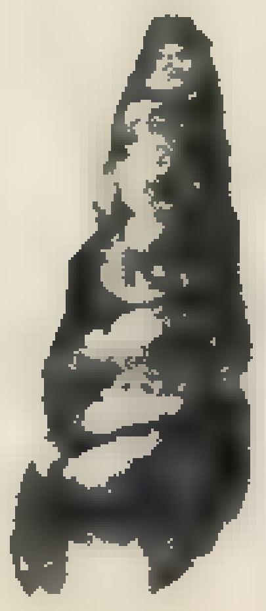
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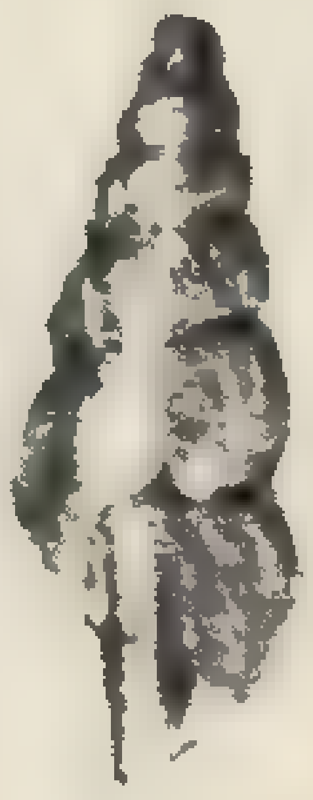
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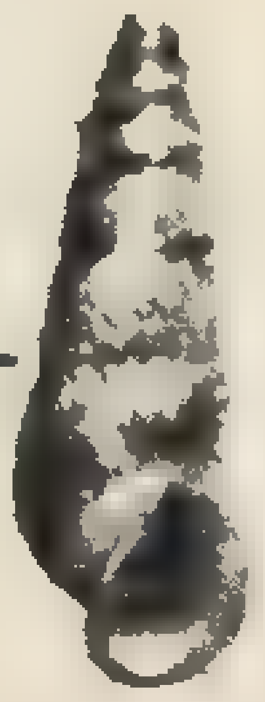
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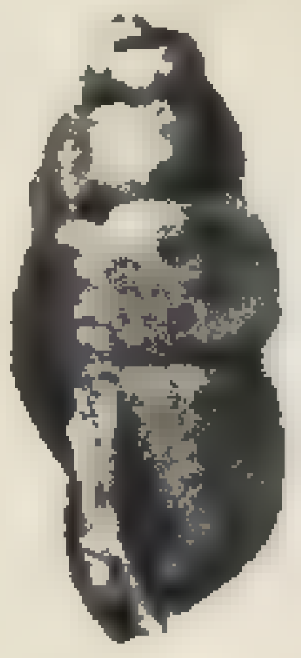
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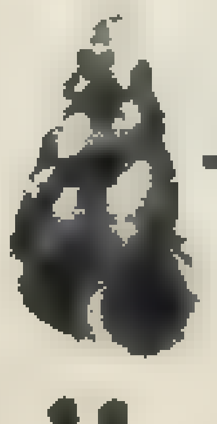
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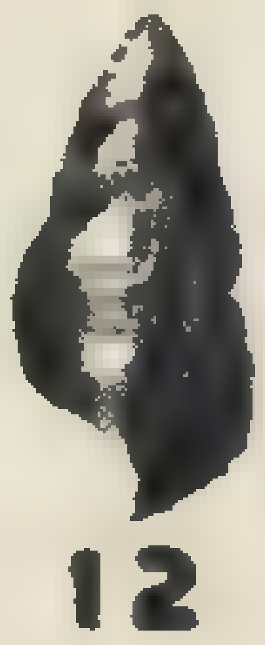
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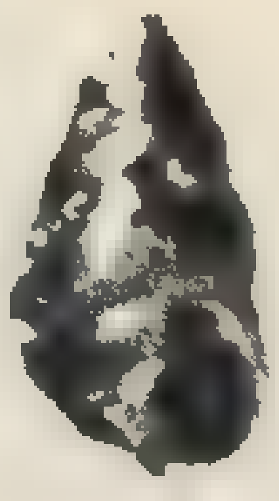
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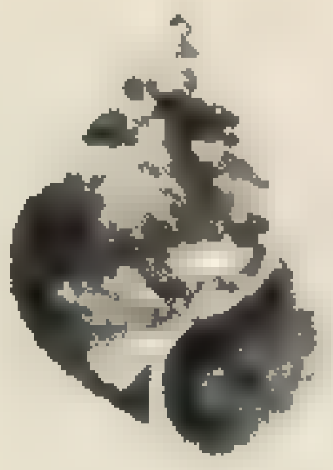
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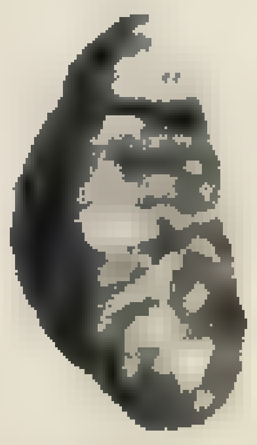
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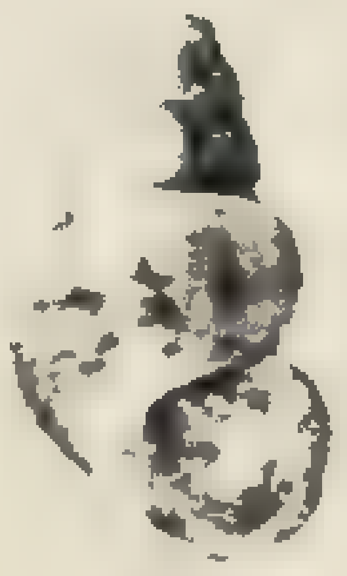
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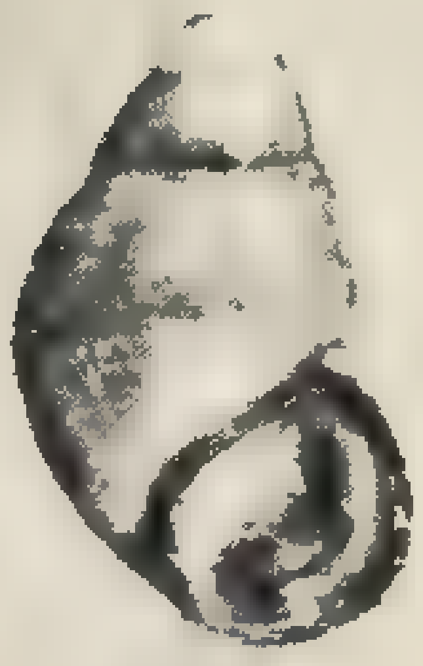
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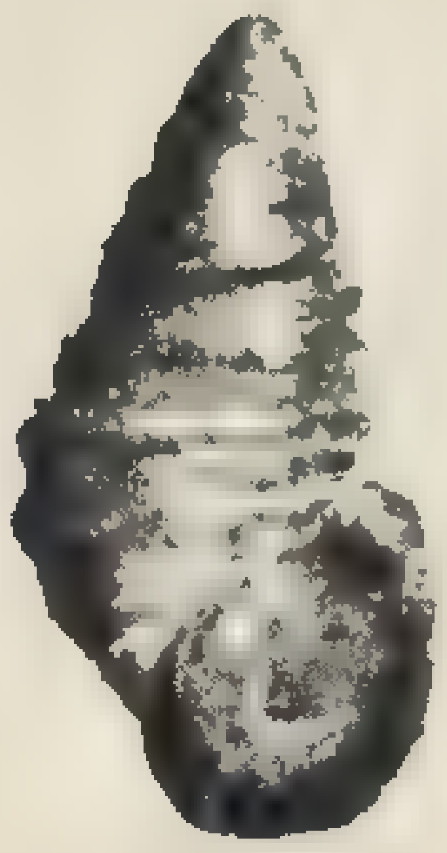
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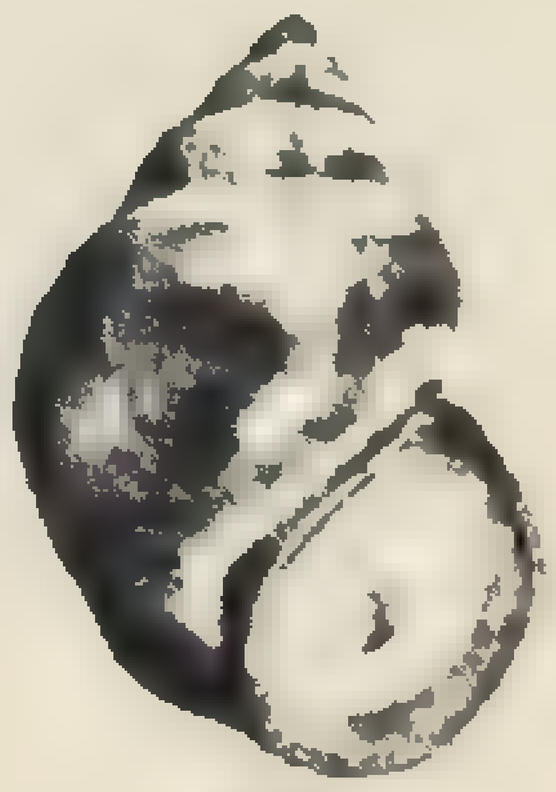
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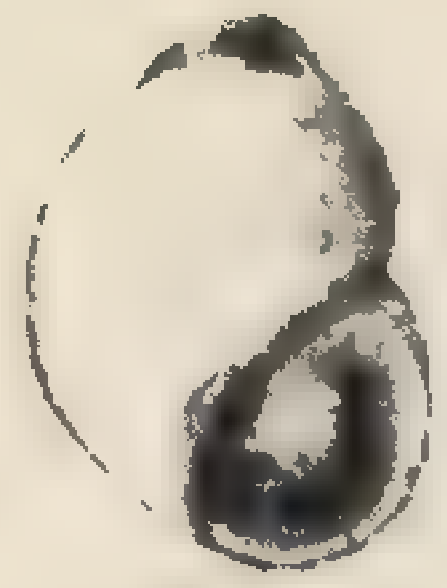
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PLATE 2

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Fig. 1. Looking through a dissecting microscope at an *Oncomelania* which has just been crushed between two slides. The fork-tailed cercariae of *Schistosoma japonicum* have burst from their sporocysts which were located in the snail's "liver." (x 100).

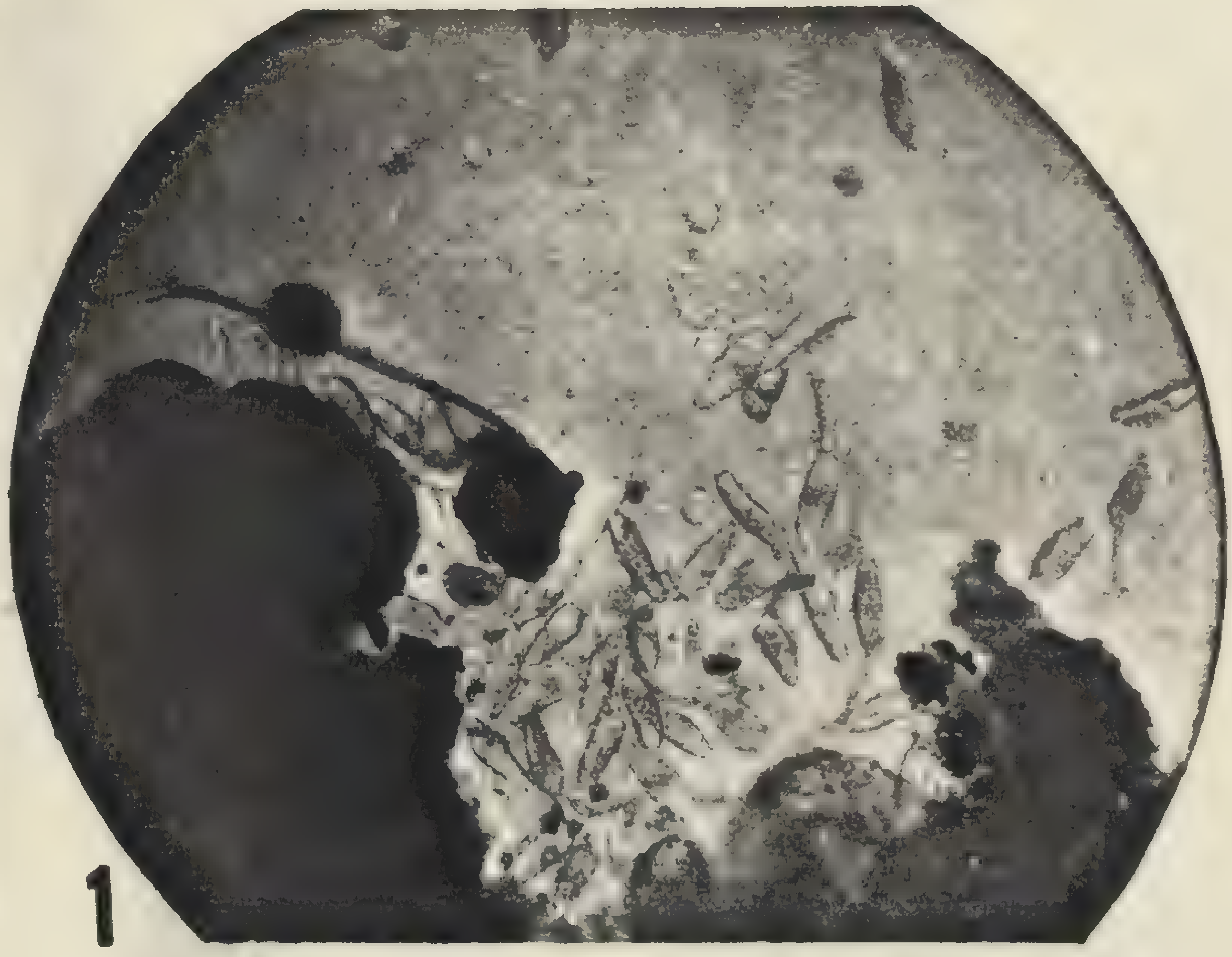
Figs. 2–3. Dorsal and ventral view of *Hippeutis cantori* Benson, intermediate host of *Fasciolopsis buski*. (x 2).

Figs. 4–5. Dorsal and ventral view of *Segmentina hemisphaerula* Benson, intermediate host of *Fasciolopsis buski*. (x 2). Note internal, calcareous lamellae showing through shell in fig. 4.

Fig. 6. *Septaria borbonica suborbicularis* Sowerby. (slightly reduced). Philippines and East Indies.

Fig. 7. *Neritina zigzag* Lamarck and its calcareous operculum. (natural size).

Fig. 8. *Pila ampullacea* Linnaeus (reduced ½) and its calcareous operculum.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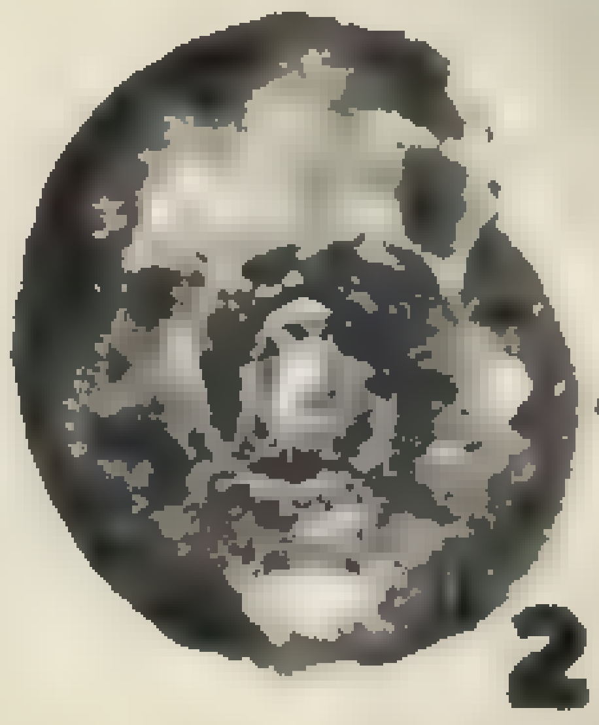
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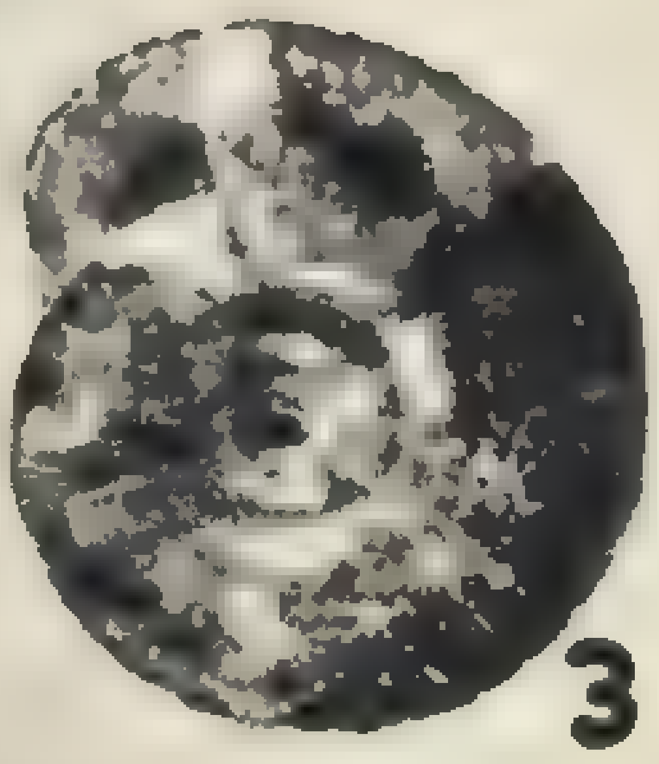
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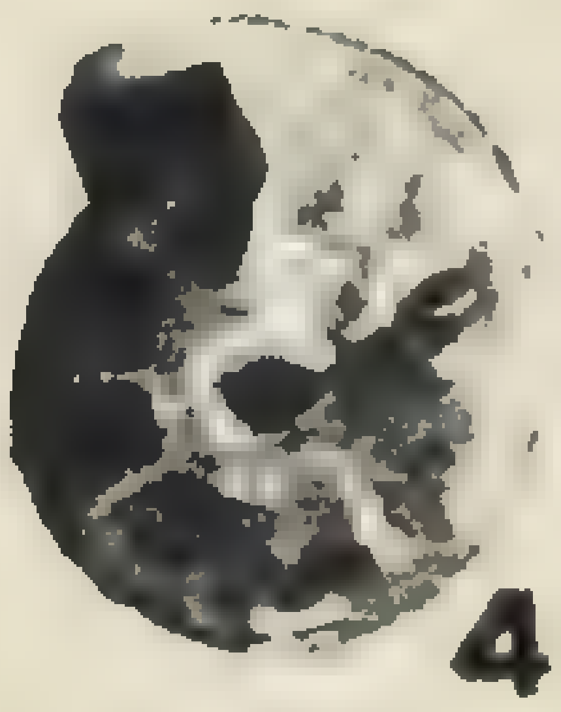
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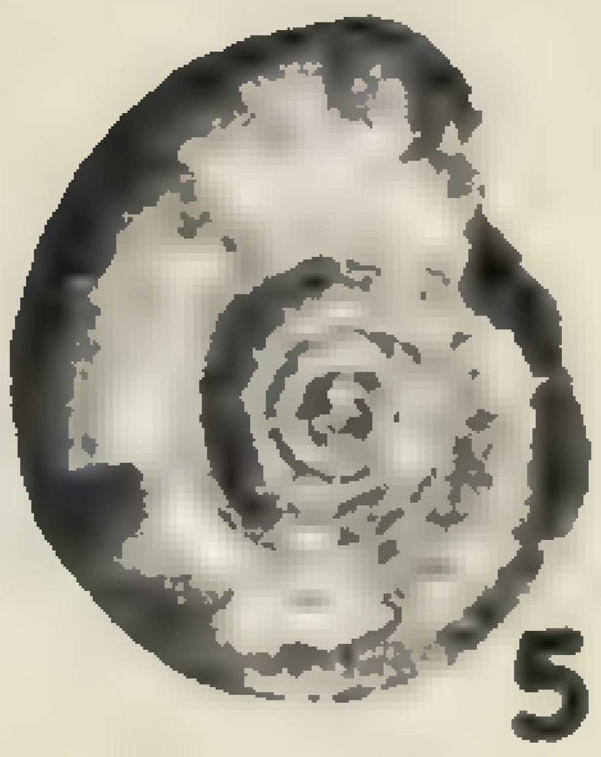
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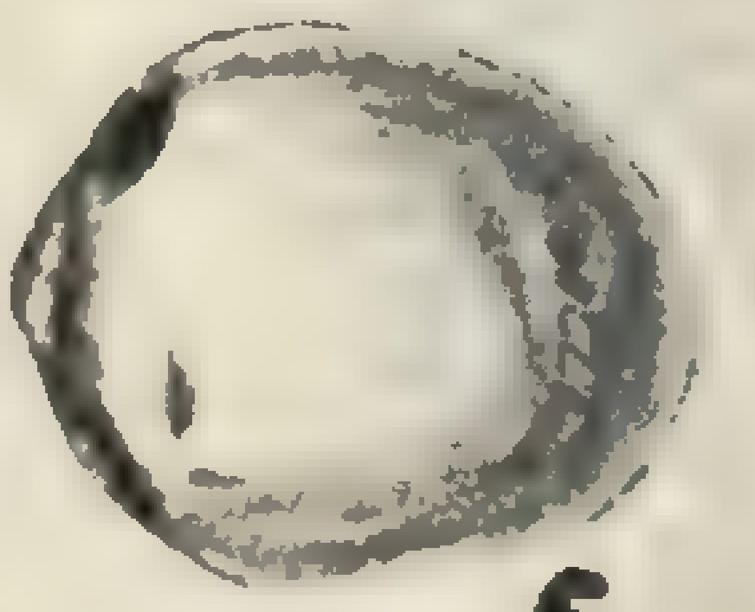
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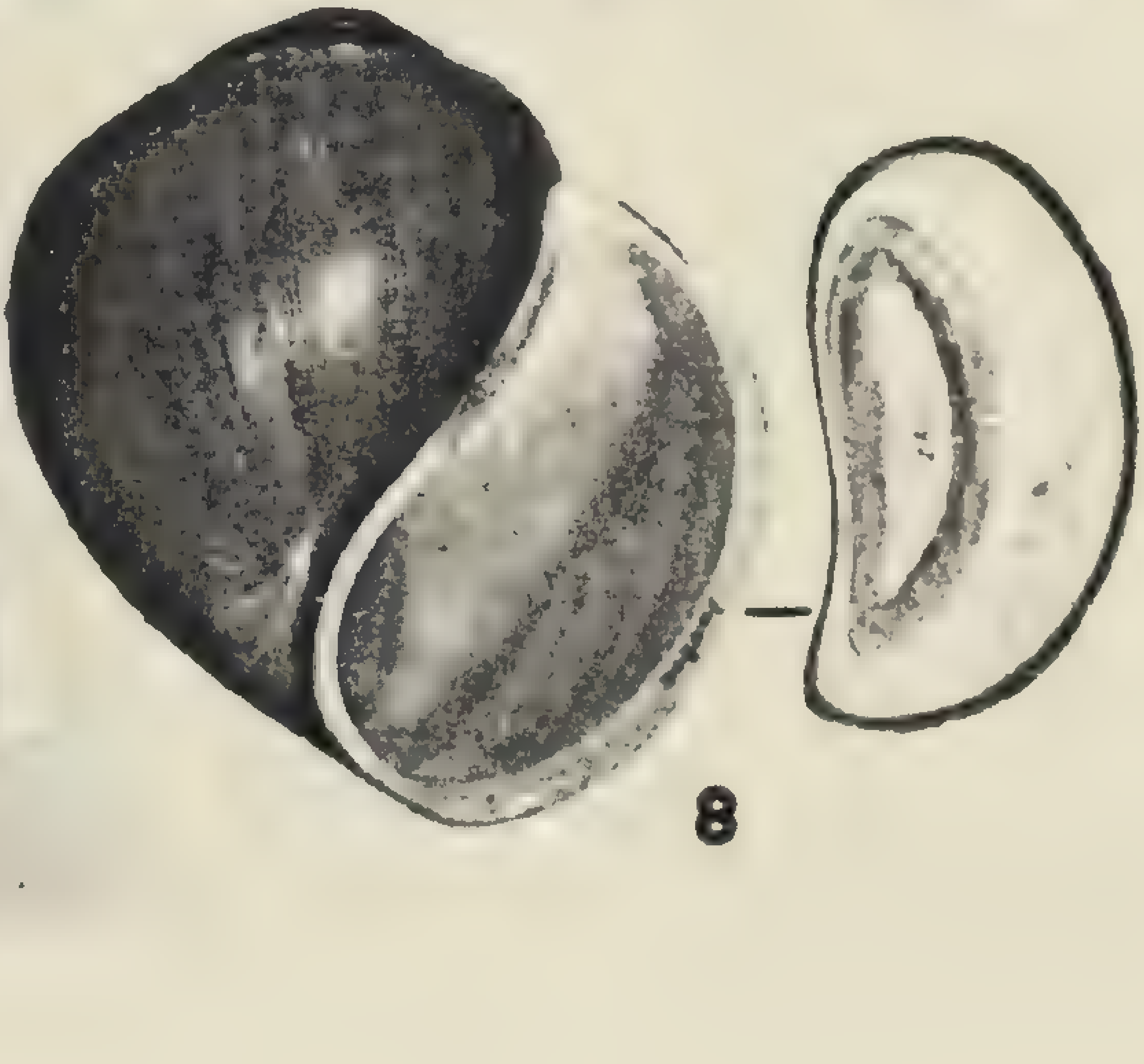
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PLATE 3

PLATE 3

Fig. 1. *Brotia asperata* Lamarck. (slightly reduced). Philippines.

Fig. 2. *Stenomelania fuscata* Born. (reduced ½). Philippines, East Indies and Guam Island, Marianas.

Fig. 3. *Balanocochlis inermis* Lesson. (natural size). Philippines and East Indies.

Fig. 4. *Thiara (Tarebia) granifera* Lamarck. (natural size). An intermediate snail host of *Paragonimus westermani*. Formosa, Philippines and East Indies.

Fig. 5. *Thiara (Sermyla) riquettii* Grateloup. (natural size). Philippines and East Indies.

Figs. 6–7. *Semisulcospira libertina* Gould. (natural size). An intermediate snail host of *Paragonimus westermani*.

Fig. 8. *Hua (Namrutua) ningpoensis* Lea. (natural size). Yangtze Valley, China.

Fig. 9. *Hua dolium* Heude. (natural size). Eastern China.

Figs. 10–11. *Hua amurensis* Gerstfeldt. (natural size). Northeast China and Korea. An intermediate snail host of *Paragonimus westermani*.

Fig. 12. *Thiara (Plotiopsis) scabra* Müller. (natural size). East Indies, Philippines, Formosa, Marianas and Okinawa.

Fig. 13. *Thiara (Melanoides) tuberculata* Müller. (reduced ⅓). Philippines, East Indies, southern Asia.

Fig. 14. *Viviparus angularis* Müller. (reduced ½). Eastern China.

Figs. 15–16. *Cerithidea cingulata microptera* Kiener. (natural size). The intermediate snail host of *Heterophyes heterophyes* in Japan.

Fig. 17. *Viviparus japonicus* von Martens. (reduced ½). Japan and China.

Fig. 18. *Lymnaea (Radix) auricularis* Linnaeus. (natural size). An intermediate snail host of *Fasciola hepatica* Linnaeus.

Figs. 19–20. *Myxas cumingiana* Pfeiffer. (natural size). Philippines.

Fig. 21. *Physastra hungerfordiana* Nevill. (natural size). Philippines.

Fig. 22. *Stenothyra deltae* Benson. (x 3). India. Other species occur in China and the Philippines.

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PLATE 4

PLATE 4

Fig. 1. Creek 10 miles east of Dagami, northeastern Leyte Island, Philippines. *Oncomelania quadrasi* Moellendorff, the Schistosomiasis snails, are found farther up this creek where the banks are more heavily shaded. The snail usually prefers a creek much smaller than the one shown here.

Fig. 2. Bend in the upper Binahaan River near Dagami, Leyte Island. The frequent floodings and constantly shifting sands in rivers of this size do not offer suitable conditions for *Oncomelania*. A few *Thiara* are found along the banks.

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PLATE 5

PLATE 5

The Poison Cone Shells

Fig. 1. *Conus geographus* Linnaeus. 3 to 5 inches in length. Color: irregular patches of mahogany brown with two or more indistinct spiral bands of the same color over a cream or bluish white ground.

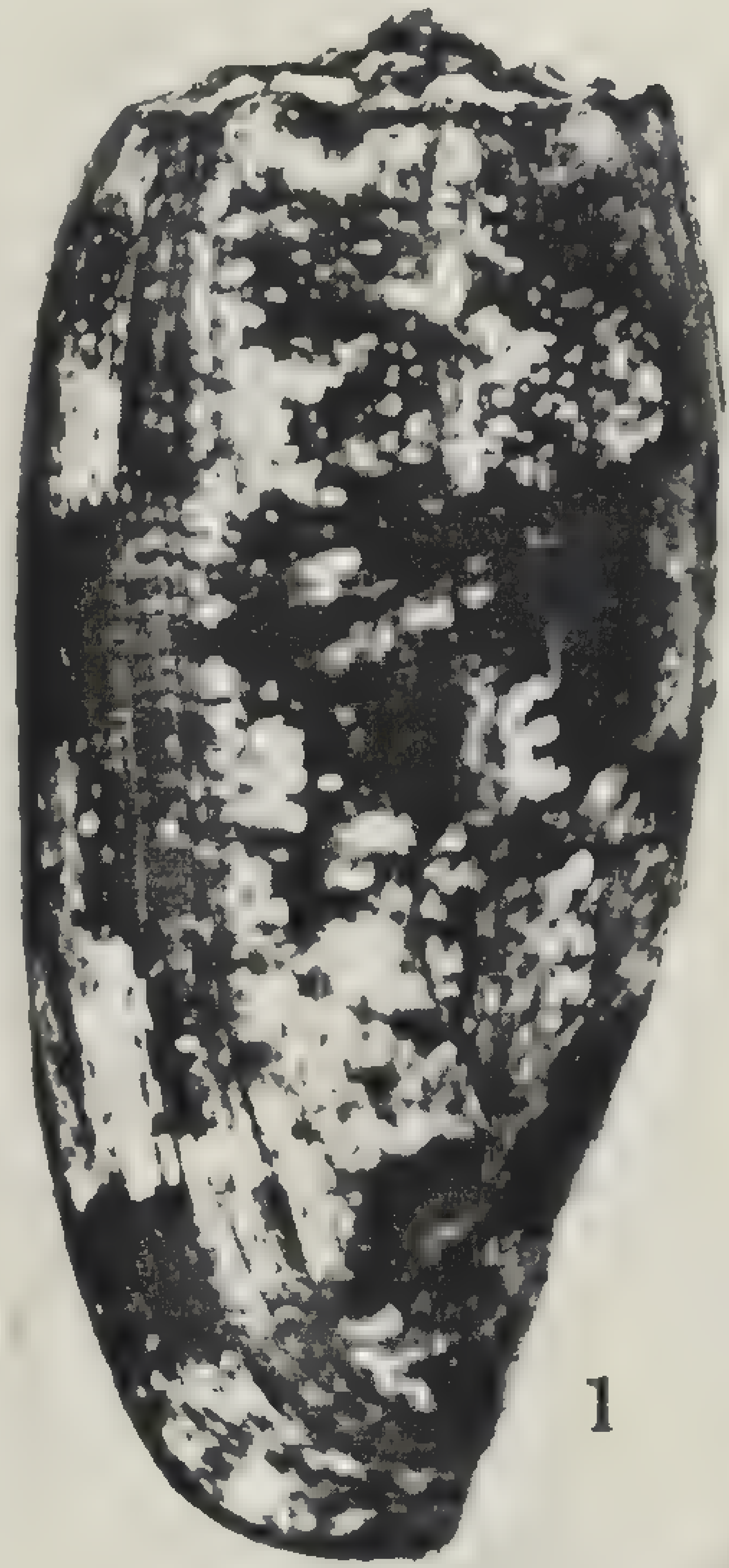
Fig. 2. *Conus aulicus* Linnaeus. 3 to 5 inches in length. Color: numerous white triangular figures on a dark mahogany background. Compare its shape with that of *C. textilis*.

Fig. 3. *Conus marmoreus* Linnaeus. 2 to 4 inches in length. Color: white, even patches on a chocolate background.

Fig. 4. *Conus tulipa* Linnaeus. 2 to 3 inches in length. Color: irregular patches of mahogany brown with two bands of the same color over a bluish white background. There are numerous and finely lengthened dots arranged in rather close-set spiral lines. Colors smudged.

Fig. 5. *Conus textilis* Linnaeus. 2 to 4 inches in length. Color: numerous white triangles over a yellowish brown background.

Fig. 6. *Conus striatus* Linnaeus. 3 to 4½ inches in length. Color: irregular patches of dark chocolate brown, more regular in the center and at the base to form two rather indistinct bands. The background is a pale brownish cream. Fine, brown spiral lines present.



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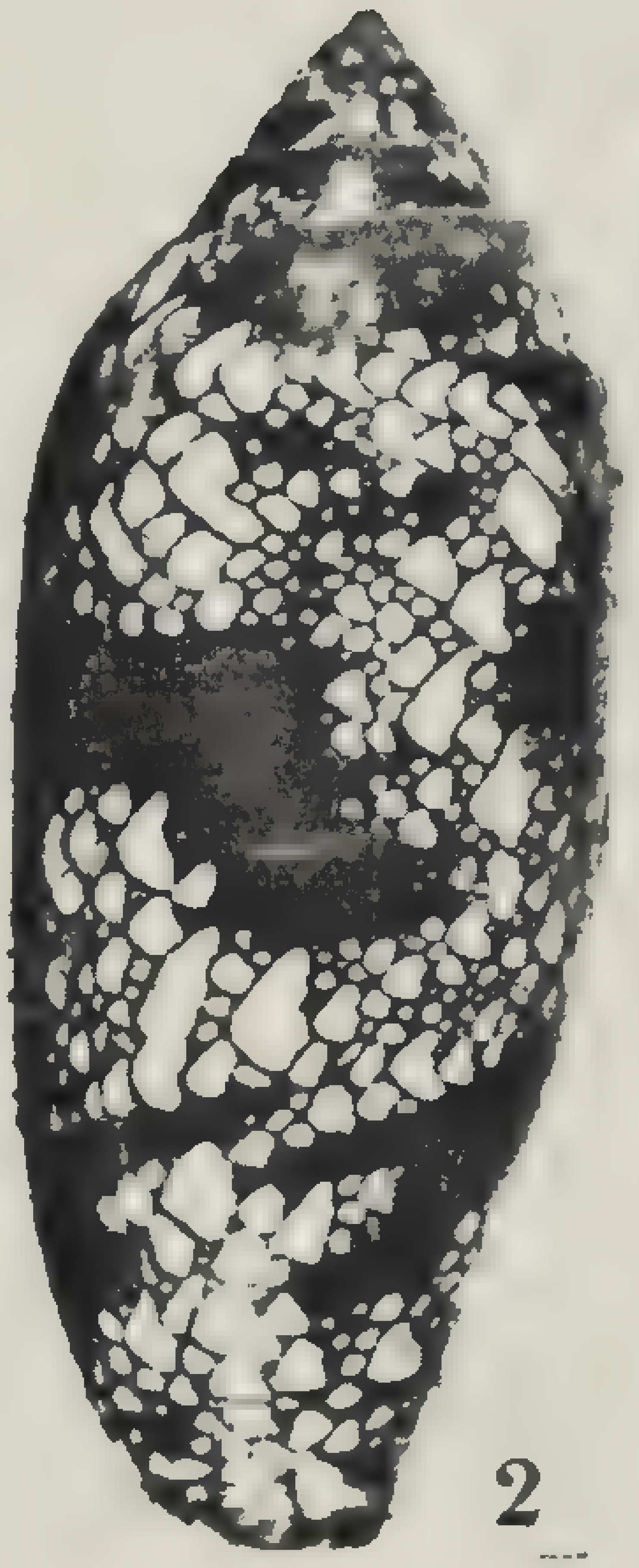

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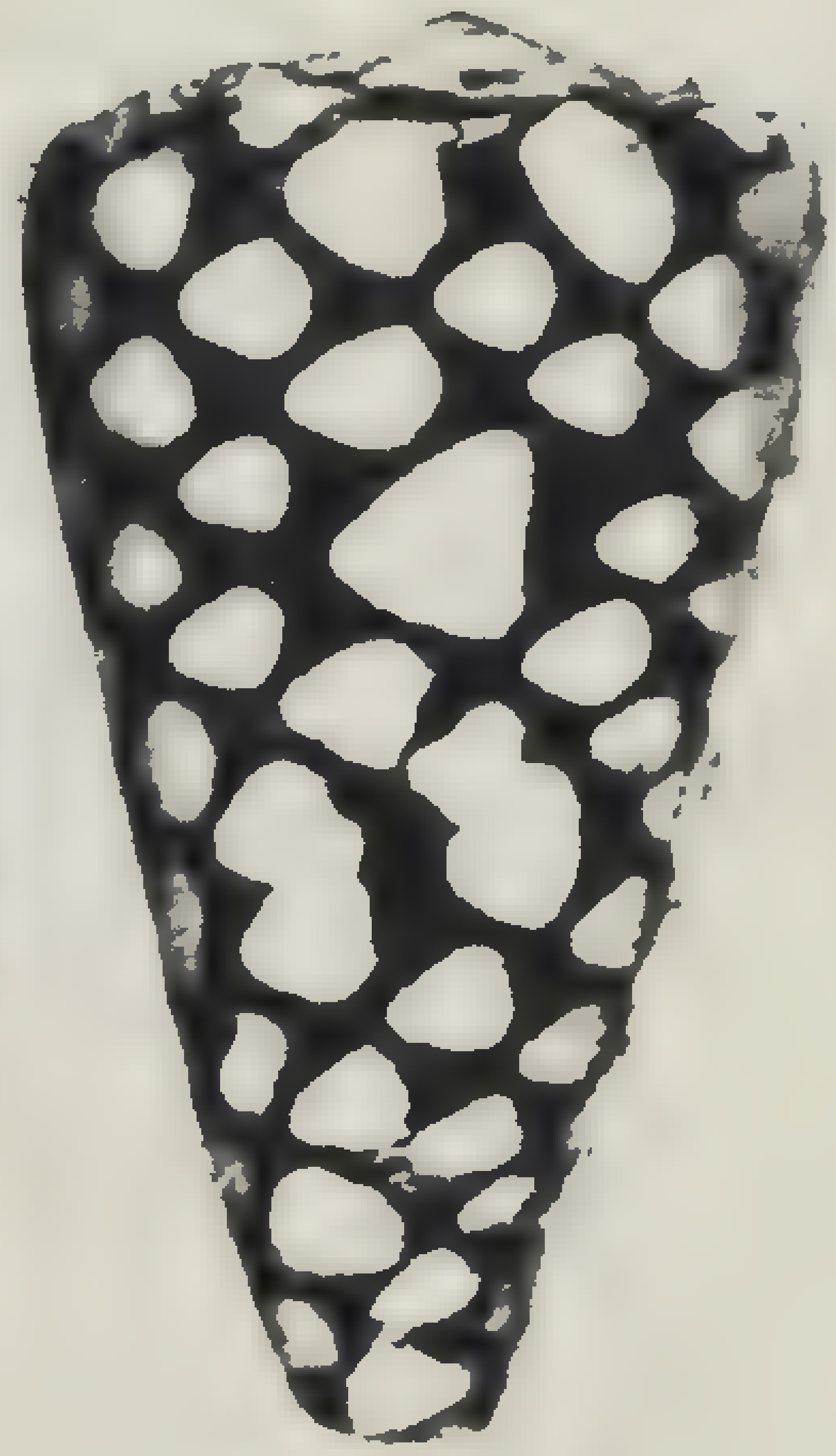

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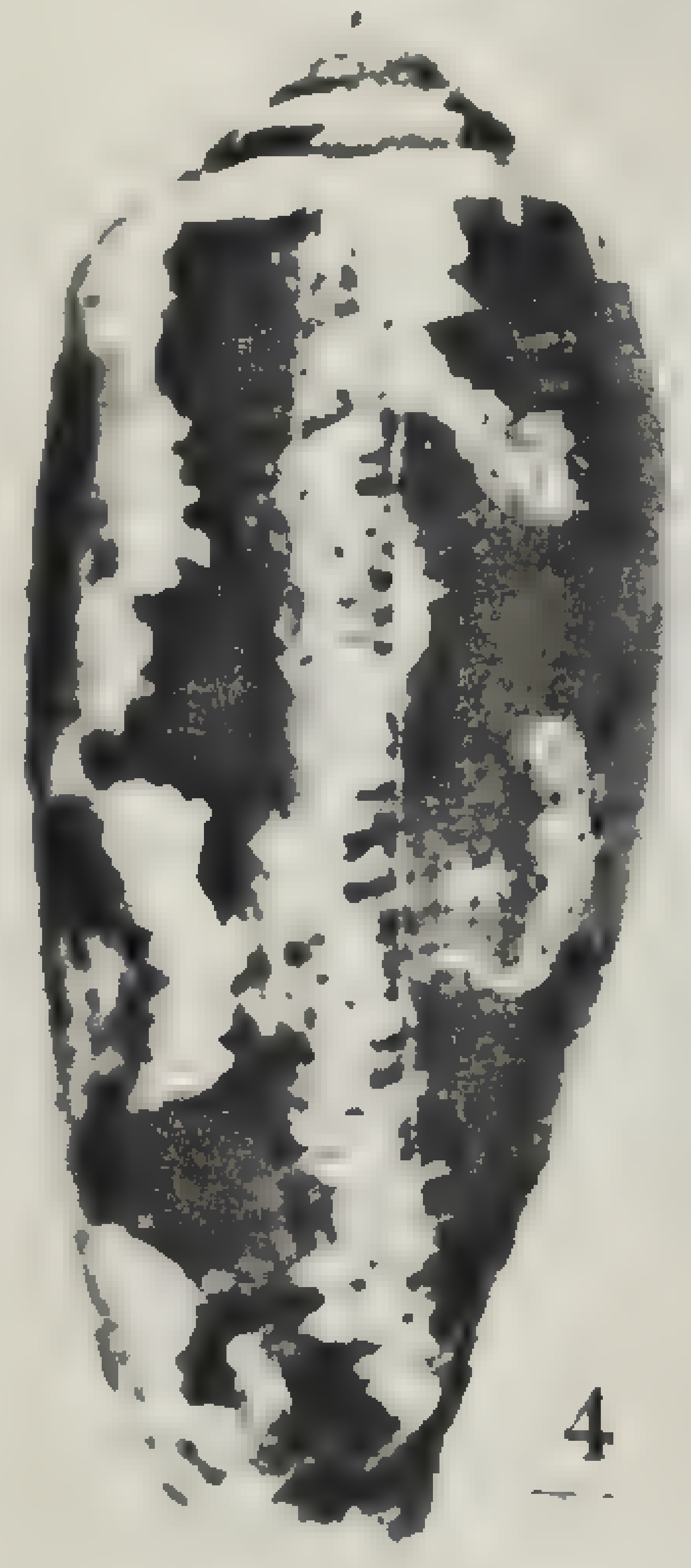

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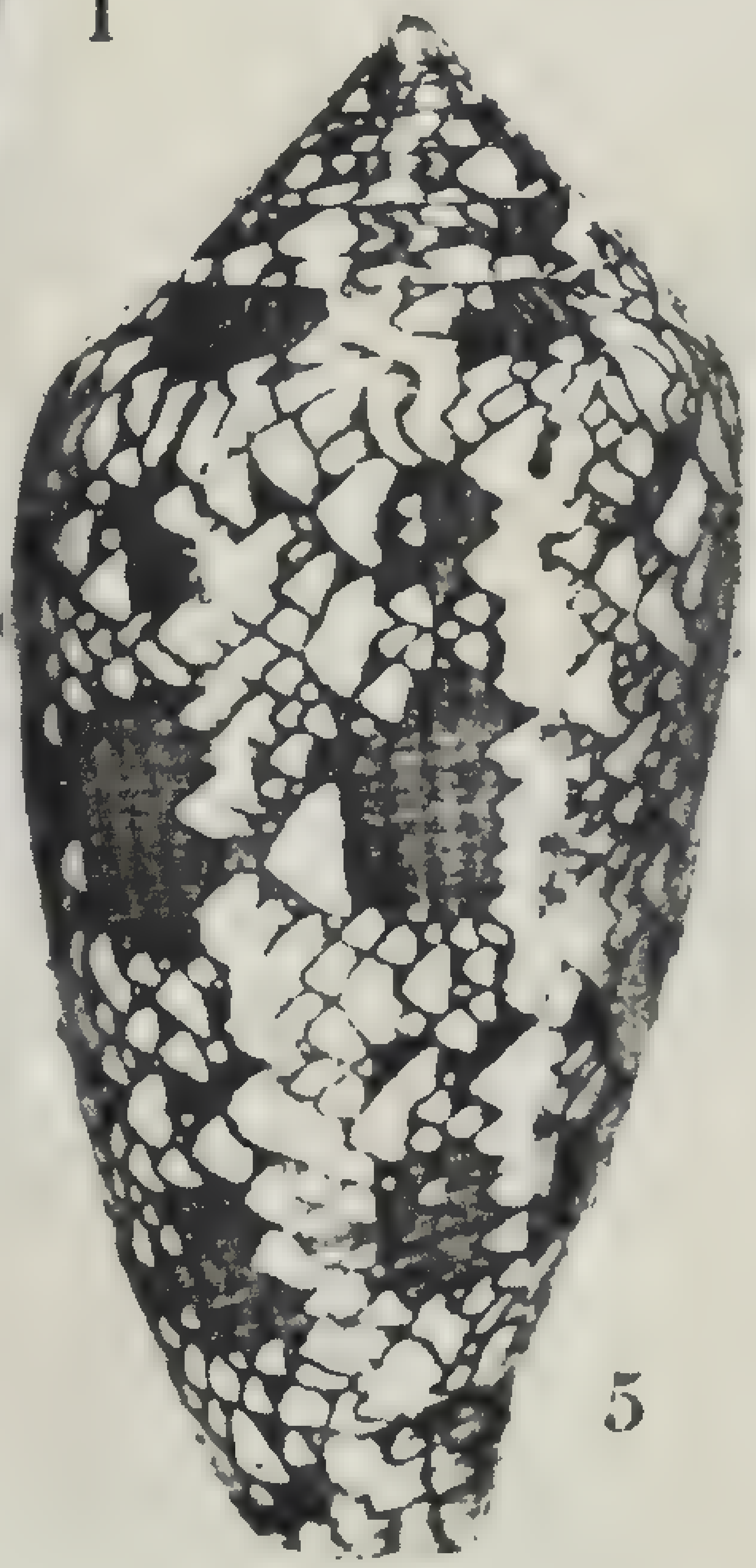

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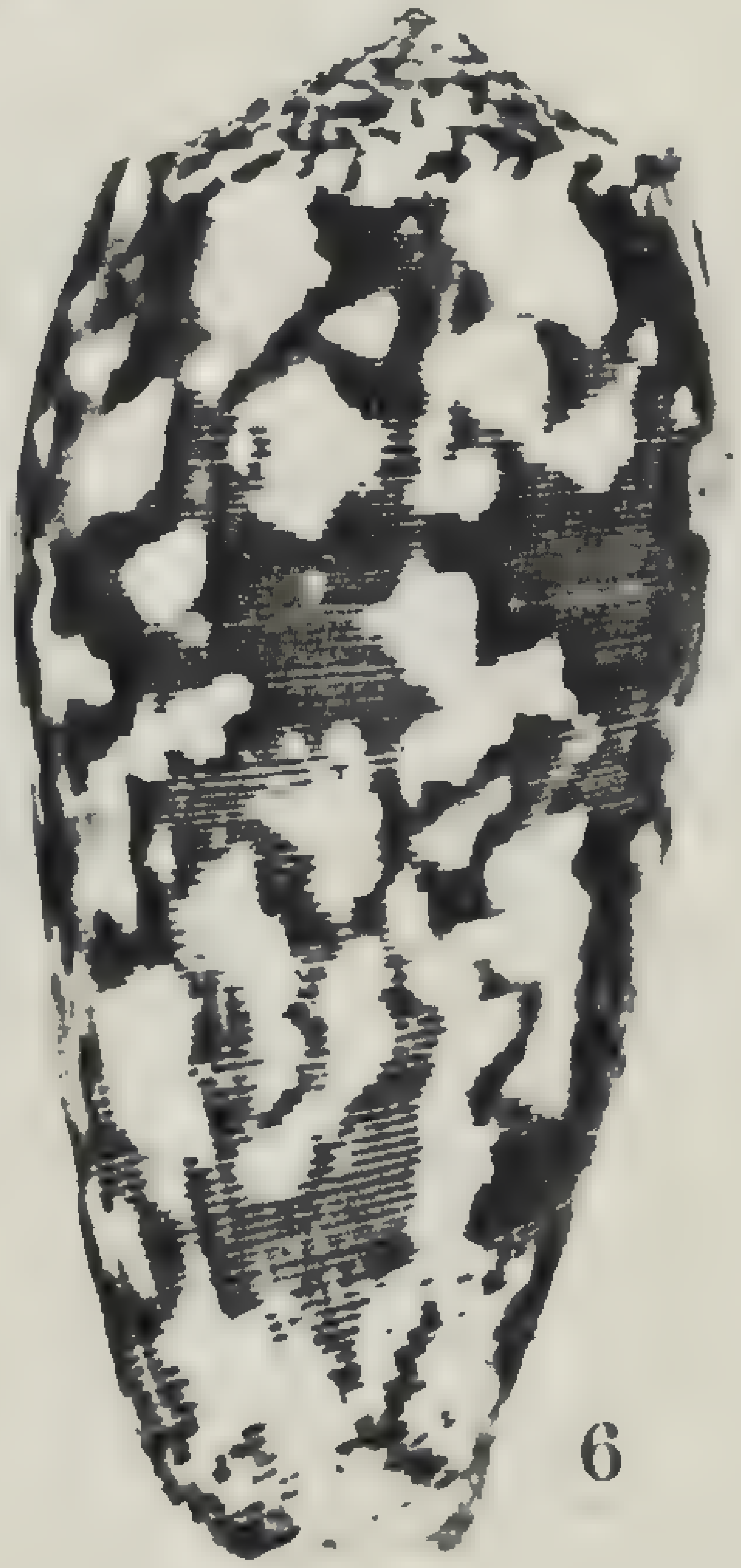

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Bulletin of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
Vol. 100, No. 4

Museum of Comparative Zoology
MAY 25 1948
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THE SPIDERS OF HISPANIOLA

By Elizabeth B. Bryant

With Twelve Plates

CAMBRIDGE, MASS., U. S. A.
PRINTED FOR THE MUSEUM
May, 1948

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OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY

AT HARVARD COLLEGE

The Bulletin and Memoirs are devoted to the publication of investigations by the Staff of the Museum or of reports by specialists upon the Museum collections or explorations.

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Comparative Zoology
MAY 25 1948

No. 4.—*The Spiders of Hispaniola*

By Elizabeth B. Bryant[1]

CONTENTS

PAGE
Introduction 332
  Previous Investigations 332
  Table of species found on islands of the Caribbean . . 333
Systematic List 334
  Suborder Mygalomorphae 334
    Family Barychelidae 335
    Family Theraphosidae 337
  Suborder Arachnomorphae 339
    Family Filistatidae 339
    Family Dysderidae 339
    Family Oonopidae 340
    Family Caponiidae 342
    Family Oecobiidae 344
    Family Amaurobiidae 345
    Family Pisauridae 349
    Family Lycosidae 352
    Family Oxyopidae 357
    Family Sicariidae 363
    Family Pholcidae 365
    Family Dictynidae 372
    Family Theridiidae 373
    Family Linyphiidae 386
    Family Uloboridae 393
    Family Deinopidae 394
    Family Argiopidae 394
    Family Mimetidae 395
    Family Ctenidae 397
    Family Gnaphosidae 406
    Family Sparassidae 413
    Family Selenopidae 414
    Family Thomsidae 418
    Family Clubionidae 420
Appendix 439
Bibliography 441
Index of genera and species 445

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[1] Published with the aid of a special gift from Mr. G. R. Agassiz.

The Museum's collection of spiders from Hispaniola dates from 1873. That year Dr. P. R. Uhler, then a member of the Museum staff, visited Haiti on a collecting trip. His principal interest was insects, but incidentally he took a number of spiders. So far as can be learned, all his time was spent in the western part of Haiti. On his return, the greater part of the *Araneae* were sent by the Curator of Insects, Dr. A. Hagen, to his friend, Graf Eugen von Keyserling, for study, with the result that a number of the new species were recognized by him. From time to time, these were described by Keyserling and figured in the "Verhandlungen der k.k. zoologisch-botanischen Gesellschaft in Wien."

The next important addition to the collection was from Dr. W. M. Mann. While on a collecting trip in Haiti during the winter of 1912–13, he was requested by Mr. Samuel Henshaw, the then Director of the Museum, to include spiders. This is the only collection from the island made during the winter season, when fewer spiders are adult.

The principal part of the collection, as it now stands, is due to the interest and skill of Dr. P. J. Darlington. In the autumn of 1934, Dr. Darlington made his first trip to Haiti, visiting the western part of the island, where he spent over two months collecting. He did not confine his efforts to his own field, but added much material to the spider collection. Darlington, while working over the ground already covered by earlier collectors, also included much new territory, notably the mountains of the region, of which Morne La Hotte, with an altitude of 7872 feet, is the highest. In the summer of 1938, Dr. Darlington returned to Hispaniola, devoting his attention during the greater part of three months to a study of the eastern part of the island, a region of remote peaks, each seemingly with a fauna peculiar to itself.

It should be noted, also, that the Museum is indebted to friends and former students for additions to its material. Dr. A. Audant, collecting in the vicinity of Port-au-Prince, found species new to the collection. The material sent by him from Dame Marie, in the extreme western part of the island, though small, included new and interesting species. From Puerto Plata, a district that has been little worked, we received material from Donald Hurst that resulted in the identification of *Singa crewi* Banks. Also, members of the Utowana Expedition, in the spring of 1934, collected at various new localities.

In all, the collection contains 224 species. Of these, 110 have been described by me as new. In 1943, my paper on "The Salticid Spiders of Hispaniola," described 49 species, and two years later, in 1945, I listed a total of 104 species of Argiopidae, of which 49 were new. The remainder, 120 species, are included in the present paper. Thirteen new genera have been proposed. Several of the genera here noted have been known previously only from South America, and others known only from the island of St. Vincent.

TABLE 1.

The number of known species of spiders found on the following islands.

	Cuba	Puerto Rico	Hispaniola	St. Vincent	Virgin Islands
Ctenizidae	0	0	0	4	2
Dipluridae	1	2	0	0	1
Barychelidae	1	0	2	1	1
Theraphosidae	4	6	2	2	5
Filistatidae	2	1	1	1	1
Dysderidae	1	1	1	1	1
Oonopidae	8	5	3	15	7
Caponiidae	2	0	2	2	1
Oecobiidae	1	1	1	0	1
Amauribiidae	0	0	3	0	0
Agelenidae	1	1	0	1	0
Hersilidae	1	0	0	0	0
Palpimanidae	1	1	0	1	0
Pisauridae	3	2	2	0	0
Lycosidae	8	4	5	1	6
Oxyopidae	4	3	6	2	1
Leptonetidae	0	1	0	3	0
Sicariidae	5	4	4	6	6
Pholcidae	12	11	7	6	5
Dictynidae	3	1	1	0	1
Theridiidae	31	23	21	25	10
Linyphiidae	7	4	8	4	0
Uloboridae	5	3	3	2	1
Deinopidae	1	1	1	1	0
Argiopidae	64	48	61	28	20
Mimetidae	2	2	2	0	0
Ctenidae	7	2	9	3	1
Gnaphosidae	10	1	4	1	1
Sparassidae	4	5	3	3	4
Selenopidae	5	3	2	1	1
Thomisidae	8	4	5	3	2
Aphantochilidae	1	0	0	0	0
Clubionidae	35	19	20	15	8
Salticidae	42	15	45	14	10
	280	173	224	146	97

In spite of the rapid growth of our knowledge of the arachnid fauna of the islands of the Caribbean, it still remains far too scanty to permit much discussion or comparison of the faunas of the several islands or groups of islands. Not only are there still large areas of virgin territory never yet examined, but there are even fewer areas where collecting throughout the year has been done.

In conclusion, I want to thank all who have assisted me, and especially do I wish to express my gratitude to Mr. Nathan Banks for his unfailing interest and help.

Sub-Order MYGALOMORPHAE

Species reported from Hispaniola

Family BARYCHELIDAE

Trichopelma nitidum Simon 1888

Family THERAPHOSIDAE

Cyrtopholis agilis Pocock 1903
" *cursor* (Ausserer) 1875
Phormictopus cancerides (Latreille) 1806
Pamphobeteus nigricolor (Ausserer) 1875
Scopelobates sericeus Simon 1903

Only two of these six species are here recognized. Of the others, *Pamphobeteus nigricolor* (Ausserer), was described from a specimen from New Granada in the Keyserling Collection and at that time an immature female in the Koch Collection from San Domingo was referred to it. This, undoubtedly, is a misidentification, as the genus is wholly South American. Two species, *Trichopelma nitidum* and *Scopelobates sericeus* were both described by Simon from females from San Domingo. As most of the generic characters are based on males, these may ultimately prove to be known species. The remaining species, *Cyrtopholis cursor* (Ausserer), has been found on several of the islands of the Caribbean, but it is lacking in all recent collections from Hispaniola.

Two new species of the genus *Psalistops* are here described. The genus was based by Simon on three species from Venezuela. Later, Dr. Petrunkevitch referred a new species, *corozali* Petr. from Puerto Rico, to it. This species is very close to one found in Haiti, but neither belong to the genus in the strict sense.

Family BARYCHELIDAE

Genus PSALISTOPS Simon 1889

PSALISTOPS fulva spec. nov.

Figures 2, 5, 9

Male. Length, 12.0 mm., ceph. 6.0 mm. long, 4.0 mm. wide, abd. 6.0 mm. long, 3.3 mm. wide.

Cephalothorax brown, with many soft white hairs, anterior margin about half the greatest width, wides rounded, cephalothorax quite low, thoracic groove transverse, deep; *eyes* on a very low turret, anterior row strongly procurved, eyes equidistant, a.m.e. largest of the eight, convex, separated by less than a diameter, posterior row about straight, p.m.e. smallest of the eight, oval, about touching p.l.e., lateral eyes separated by a diameter of a.l.e.; *quadrangle* wider than long and wider behind; *clypeus* vertical, below a.l.e. about equal to diameter of a.m.e., with a short row of bristles on the margin below eyes; *mandibles* reddish-brown, covered with silvery hairs, porrect, fang groove with scopula of long hairs on retrolateral margin, fangs parallel and very slender; *labium* wider than long, two rows of small granules parallel to tip; *maxillae* slightly divergent, fully three times as long as labium, prolateral margin with a scopula of orange-red hairs, a distinct lobe on upper prolateral margin and a larger lobe at base, scattered granules on basal half; *sternum* slightly convex, with many short bristles, nearly as wide as long; *abdomen* cylindrical, about one-third as wide as long, bright yellow with a median dark stripe which divides into a pair of serpentine stripes and forms a median row of pale spots on distal half, many long bristles, venter pale; *spinnerets*, two pairs, median pair very small, separated by more than a diameter, posterior pair long and slender, three jointed, basal joint longest, terminal joint very short and conical; *legs*, 4–1–2–3, brown, iridescent scopula heavy on anterior tarsi and metatarsi, scant on posterior tarsi and metatarsi, on fourth tarsi and metatarsi scopula divided by two rows of setae, all legs with spines, first tibia with prolateral distal spurs, ventral spur on a large apophysis bearing two contiguous slightly curved spines, the lateral spur a smaller curved spine, each with two teeth, anterior tarsi with a dorsal row of capitate hairs; *palpus* longer than cephalothorax, tibia longer than patella, tarsus short, with a dorsal depression near the tip, with a chitinized carina on prolateral side, tarsus bilobed at tip, bulb cylindrical with embolus drawn out to a fine straight point.

Female. Length, 16.0 mm., ceph. 7.5 mm. long, 6.0 mm. wide, abd. 9.0 mm. long, 5.5 mm. wide.

Cephalothorax same as male with a median row of bristles from eye turret to thoracic groove and bristles on margin of clypeus longer; *eye* turret little higher than in the male and eyes more widely separated; *mouth parts* and *sternum* same as in male; abdomen rather faded from age but the pair of serpentine dark stripes distinct, marking six median pale triangles, venter pale; *spinnerets*, median pair separated by a little more than a diameter, posterior pair with a very short terminal joint; *legs*, 4–1–2–3, rather short and stout, heavy scopula on anterior tarsi and metatarsi, median row of setae on posterior tarsi and a very faint scopula on fourth tarsi; *epigynum*, area convex with long bristles and a row of shorter bristles at the fold.

Holotype ♂ Haiti; Diquini, November 1912, (Mann)

Allotype ♀ Haiti; Diquini, November 1912, (Mann)

One of Simon's original species was based on both sexes. The male has a much lower cephalothorax than the female, and the same is true in the Hispaniola species, known from both sexes. The species *corozali* from Puerto Rico is known only from females. The generic position of *Psalistops fulva* is not very satisfactory, for in the original description of the genus, the lateral eyes are separated by less than a diameter. In both species from Hispaniola, the lateral eyes are separated by more than a diameter. The two Haitian species are probably congeneric with *Psalistops corozali* Petr. from Puerto Rico. In both the Hispaniola species the eye turret is low.

PSALISTOPS MACULOSA spec. nov.

Figures 1, 8

Male. Length, 13.0 mm., without mandibles or spinnerets, ceph. 6.5 mm. long, 4.5 mm. wide, abd. 6.0 mm. long, 3.5 mm. wide.

Cephalothorax mahogany-brown, covered with fine white hairs, anterior margin about half the greatest width, cephalic portion not high, thoracic groove long, deep and transverse; *eye turret* above margin of clypeus, area wider than long, anterior row of eyes strongly procurved, eyes subequal, a.m.e. convex, separated by less than a diameter and from a.l.e. by less than a radius, posterior row same length as anterior row, very slightly recurved, p.m.e. and a.l.e. almost touching, p.m.e. slightly angular, separated from a.m.e. by less than a short diameter of p.m.e., lateral eyes separated by a diameter of a.l.e.; *quadrangle* of median eyes wider behind and not so high as wide; *clypeus* vertical, below a.l.e. less than a radius of a.l.e.; *mandibles* red-brown, covered with short white hairs, porrect, parallel, fang groove long, with a thick scopula of long hairs on each margin, a row of small teeth on inner margin, fang long and slender; *labium* reddish, wider than long, tip emarginate, middle area with small granules; *maxillae* divergent, with a thick scopula of reddish-orange hairs on inner margin, basal portion with granules, upper inner angle produced in a lobe; *sternum* nearly as wide as long, probably in life covered with short stiff bristles, as a few remain on margins; *abdomen* cylindrical, with a distinct pattern of pale spots on a darker back ground, the dark portion in life covered with long and short bristles, venter pale, with two kinds of hairs; *spinnerets*, two pairs, middle pair small, contiguous, lateral pair separated by less than a diameter, three-jointed, basal joint longest, terminal joint short and conical; *legs*, 4–1–2–3, all tarsi scopulate, fourth tarsus with lateral scopula of reddish-orange hairs on sides, separated by rows of long bristles which form a distinct stripe, legs spiny, I tibia with two distal spurs, ventral spur on a distinct apophysis, long and slender, bifid, with lower portion short and pressed close to the larger spine, lateral spur about half as long and bent, no dorsal basal spine on III and IV tibiae; *palpus* much longer than cephalothorax, all joints covered with short white hairs, tibia almost twice as long as patella, distally much narrowed, a prolateral row of 3 spines, tarsus distally bilobed, dorsally excavate with a prolateral carina and a median row of spicules, each bearing a slender hair, bulb sub-globose, with tip prolonged in a long slender point.

Holotype ♂ Haiti; Milot, January 1913, (Mann)

Family THERAPHOSIDAE

Genus CYRTOPHOLIS Simon 1892

CYRTOPHOLIS AGILIS Pocock

Figures 6, 7

Cyrtopholis agilis Pocock, 1903, p. 97. "♂ San Domingo"

Male. Length, 23.0 mm., ceph. 11.0 mm. long, 8.5 mm. wide, abd. 10.5 mm. long, 6.5 mm. wide.

Cephalothorax mahogany-brown with many colorless hairs, rather flat, radial striae distinct, anterior margin more than half the greatest width, with a fringe of long hairs, sides rounded, thoracic groove deep, transverse; *eyes* on a small turret, anterior row procurved, eyes subequal, a.m.e. separated by less than a diameter and from a.l.e. by a little less, posterior row slightly recurved, same length as anterior row, p.m.e. small, round, p.l.e. about two-thirds the diameter of a.l.e., lateral eyes separated by about a diameter of a.l.e., median eyes separated by about a diameter of p.m.e.; *quadrangle* wider than high and wider behind; eye turret on margin; *clypeus* below a.m.e. equal to more than a diameter of a.m.e.; *mandibles* reddish-brown, porrect, covered with long hairs, fang groove long, prolateral margin with eleven teeth, retrolateral margin with a scopula of long hairs, fang long; *labium* reddish-brown, wider than long, a band of granules just below the tip; *maxillae* fully three times as long as labium, divergent, prolateral margin with a scopula of long, orange-red hairs, ending in a distinct point, basal margin with a large rounded point, basal half with dark granules; *sternum* brown, flat, longer than wide, (4.5 mm. : 3.5 mm.), with long dark bristles and short hairs; fourth coxae contiguous; *abdomen* brown, covered with long golden hairs, venter dark with colorless hairs; *spinnerets,* two pairs, median pair short, separated by less than a diameter, posterior pair long, three-jointed, basal joint longest, distal joint longer than middle joint; *legs,* 4–1–2–3, brown with many hairs, anterior tarsi and metatarsi with a thick scopula, posterior tarsi and distal half of metatarsi with scopula, scopula of fourth tarsus divided by a median line of setae, I tibia with two ventral distal spurs, ventral spur short and rounded, the other spur long and curved, tip blunt with a stout spine at inner side, both spurs covered with short hairs, III femur not enlarged; *stridulating organ,* I trochanter with a prolateral group of clavate bristles, irregularly placed, trochanter of palpus with a retrolateral group of a few clavate bristles; *palpus* long, tibia with 3 prolateral spines, tarsus short, bilobed at tip, bulb rather small, embolus slightly flattened as figured.

♂ Haiti; Dame Marie, 1941, (Audant)

The type is a little smaller than the specimen described.. Pocock stressed, as a specific character, the number of clavate bristles on the first trochanter and those on the trochanter of the palpus. The number probably varies with the individual, as the specimen from Dame Marie has many more than the type.

Genus PHORMICTOPUS Pocock 1901

PHORMICTOPUS CANCERIDES (Latreille)

Mygale cancerides Latreille, 1806, p. 83. "St. Domingo"

no. 74 ♀ Haiti; Gonaives, (Albert Hilchenbach) f. Chamberlin
no. 75 ♂ Haiti; Jeremie, (Dr. Weinland), f. Chamberlin
♂ Haiti; Port-au-Prince, July 1941, (Audant)

Sub-Order ARACHNOMORPHAE

Family FILISTATIDAE

Genus FILISTATA Latreille 1810

FILISTATA HIBERNALIS Hentz

Filistata hibernalis Hentz, 1842, p. 227, pl. 8, fig. 6. "♂ South Carolina on the sea-coast, North Carolina on the banks of the Tennessee."

♂ ♀ Haiti; Port-au-Prince, (Mann)
♂ ♀ Haiti; Cap Haitien, January 1913, (Mann)
♀ Haiti; Port-au-Prince, July 1941, (Audant)
♀ Dom. Rep.; Puerto Plata, July 1941, (Hurst)

Family DYSDERIDAE

Genus ARIADNA Audouin 1825

ARIADNA MULTISPINOSA spec. nov.

Female. Length, 8.8 mm., ceph. 4.0 mm. long, 2.5 mm. wide, abd. 5.5. mm. long, 3.5 mm. wide.

Cephalothorax chestnut-brown, shining, cephalic portion only slightly narrowed, sides almost parallel, no thoracic groove; *eyes* on middle half of head in three groups, eyes subequal, median eyes round and touching form a straight line with p.l.e., lateral eyes touching; *clypeus* high and slightly convex, with several very long bristles; *mandibles* long, vertical, darker than cephalothorax, with many long bristles in rows that curve towards median margin, a row of bristles each from a granule parallel to groove, fang groove short; *labium* longer than wide, tip narrowed; *maxillae* almost twice as long as labium and much narrowed; *sternum* oval, almost twice as long as wide, (7.0 : 4.0), pale brown, convex, with scattered hairs; *abdomen* oval, convex, paler than cephalothorax, slightly reddish in middle area, with many short colorless hairs, venter paler than dorsum, spinnerets closely grouped at tip; *legs*, III pair directed forward, 1–2–4–3, rather pale, with distal joints darker, I femur bent, spines, no patellae spines, I pair, femur, left, 2 long prolateral spines on distal third, right, with 3 long prolateral spines, ventral, 0, dorsal, 0, tibia, dorsal, 0, ventral, 2 widely separated rows, 8p., 11r., with 4, 6, 8 from base very short, all spines from a raised base, metatarsus, dorsal, 0, ventral, 10p., 9r., all from a raised base, II pair, femur, dorsal, 1 near tip, tibia and metatarsus same as I pair, III pair, femur, 0, tibia, ventral, Op., 3r., metatarsus, ventral, Op., 3r., IV pair, no spines; *epigynum*, opening with anterior margin a slightly convex lip.

Holotype ♀ Dom. Rep.; Loma Rucilla Mountains, Pico del Yaque, 8,000–10,000 feet, June 1938, (Darlington)

Paratype ♀ pullus Dom. Rep.; Cordillera Central, rain forest, near Valle Nuevo, 6,000 feet, August 1938, (Darlington)

Ariadna multispinosa has more spines on the anterior pairs of legs than *Ariadna arthuri* Petr. from Puerto Rico and many more than *Ariadna solitaria* Simon from St. Vincent. The first species was based on an immature female, and there is always a possibility that the number of spines on the legs varies with each moult, as a half grown specimen from the rain forest near Valle Nuevo has only two spines on the first femur and fewer spines on the anterior tibiae and metatarsi, but it has three spines on the third tibia as in the type. The maxillae are much narrower than in the figure of *A. arthuri* Petr. but this too, may be a character that varies with each moult.

Family OONOPIDAE

Geuns DYSDERINA Simon 1891

DYSDERINA ANTILLANA Bryant

Dysderina antillana Bryant, 1942, p. 324, figs. 1, 7. "♂ Virgin Islands; St. Croix"

Female. Length, 2.2 mm., ceph. 1.0 mm. long, 0.6 mm. wide, abd. 1.3 mm. long, 0.7 mm. wide.

Cephalothorax brown, anterior margin narrowed to about half the greatest width, highest between the third pair of legs, no thoracic groove; *eyes* cover about one half the head, a.l.e. largest, round, convex, almost touching, posterior row straight, only little longer than anterior row, eyes oval, touching, p.l.e. slightly larger than p.m.e.; *clypeus* about equals radius of a.l.e.; *mandibles* brown, vertical, fang groove short; *labium* fused to the sternum, wider than long; *maxillae* twice as long as labium, slightly inclined, palpi inserted below the middle, tips abruptly narrowed; *sternum* pale as wide as long, widest between second coxae, convex, tip truncate between the fourth coxae, smooth, no hairs; all coxae globose, fourth coxae separated by almost two diameters; *abdomen* pale, cylindrical, about half as wide as long, a small narrow dark scutum on basal two-fifths, entire abdomen iridescent in certain lights, with a few short colorless hairs, venter pale with scattered dark spots beneath the surface, epigastric scutum from pedicel, including openings, area convex, spinnerets closely grouped at tip; *legs*, 1–4–2–3, III left missing, pale and slender, I pair, femur slightly enlarged at base, spines, femur, prolateral, 1–1, near tip, patella, 0, tibia, ventral, 2–2–2, long and overlapping, metatarsus, ventral, 2–2, all spines from a raised base, II pair, femur, 0, patella, 0, tibia, ventral, 2–2–2–2, metatarsus, ventral, 2–2, all spines from a raised base, posterior pairs with no spines.

Allotype ♀ Haiti; Port-au-Prince, 1–5 September 1934, (Darlington)

This specimen is probably the female of *Dysderina antillana* Bryant from St. Croix. There is a slight difference in the size of the eyes of the posterior row, but the difference in the dorsal and ventral scuta is probably sexual. The arrangement of spines on the anterior pairs of legs is the same. The cephalothorax is higher in the male than in the female.

Genus OONOPS Templeton 1834

OONOPS VALIDUS spec. nov.

Figure 3

Male. Length, 2.2 mm., ceph. 1.0 mm., abd. 1.0 mm.

Cephalothorax a bright brown, almost as wide as long, (6.0 : 7.0), anterior margin less than half the greatest width, moderately high, highest between the third pair of legs, no thoracic groove; *eyes* surrounded by black, a.l.e. largest, convex, separated by more than a diameter, posterior row slightly recurved, p.m.e. smallest, oval, touching on long diameter, p.l.e. convex and only slightly smaller than a.l.e., and touching a.l.e., a pair of black bristles below p.m.e. and two pairs below a.l.e.; *clypeus* less than a radius of a.l.e. below a.l.e.; *mandibles* light brown, vertical, fang groove short, fang slender; *labium* brown, wider than long; maxillae twice as long as labium, distal half much narrowed, tips touching, palpi inserted from basal half; *sternum* triangular, as wide as long, widest between first pair of coxae, convex with scattered hairs about the margin, fourth coxae separated by more than a diameter, all coxae elongate; *abdomen* oval, a pale yellow-green with short colorless hairs, venter pale with three black dots each side of the spinnerets, no ventral scutum from pedicel to fold; *legs*, I right missing, 4–1–2–3, same color as cephalothorax, all spines from a raised base, I pair, tibia, ventral, 5 p.,4r., long and overlapping, II pair, spines same as I pair but not as heavy; *palpus* about as long as cephalothorax, patella and tibia subequal, tarsus very narrow and almost as long as bulb, bulb very large, flattened laterally, pale about margins, embolus a graduated recurved tube from a short lobe at the tip.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Oonops validus is very close to *Oonops globimanus* Simon, 1891, from St. Vincent and Venezuela. The bulb of the latter also has a small lobe at the tip with two processes, and the legs have stiff setae instead of spines.

Genus TRIAERIS Simon 1891

TRIAERIS STENASPIS Simon

Triaeris stenaspis Simon, 1891, p. 561. "♀ Insula Sancti Vincentii."

2 ♀ Haiti; Ennery, 7 September 1934, (Darlington)

Family CAPONIIDAE

Genus CAPONINA Simon 1891

CAPONINA DARLINGTONI spec. nov.

Female. Length, 3.8 mm., ceph. 1.5 mm. long, 1.2 mm. wide, abd. 2.0 mm. long, 1.2 mm. wide.

Cephalothorax brown, median area paler, sides clouded with dark gray as radial striae, four-fifths as wide as long, anterior margin obtusely pointed, sides rounded, carapace rounded, shining, with a few long bristles, no thoracic groove, a long bristle posterior to each eye; *eyes,* two, surrounded by black, round, convex, separated by a radius; *clypeus* oblique, about equal to a diameter and a half of an eye, with several long and colorless bristles; *mandibles* reddish-brown, no boss, vertical, cone-shaped, fang groove short, oblique, margins poorly defined, no teeth, fang with a thick base, abruptly narrowed so that distal half is a slender curved spine; *labium* not fused to sternum, brown, wider than long, sides almost parallel, so that tip is only a little narrower than base; *maxillae* pale, strongly inclined over labium, tips almost touching, tips about as wide as base, palpi inserted below middle, terminal joint of palpi very long, enlarged, covered with dark hairs; *sternum* reddish-brown, darker about margins, strongly convex, almost as wide as long, (5.5 : 6.3), with many long colorless hairs, tip continued between fourth coxae, coxae separated by more than a diameter; *abdomen* oval, convex, basal half brown with an irregular median pale stripe, distal half with alternate pale and dark chevrons, entire abdomen with many short colorless hairs, venter pale, with a dark median stripe and irregular lateral blotches, spinnerets at tip, pale, anterior and median pairs in a straight line, subequal in length with posterior pair; *legs,* 4–1–2–3, III left missing, brown, tarsi pale, broken dark rings on ventral surface of femora and tibiae, anterior trochanters long, posterior trochanters shorter and swollen, no spines and a few colorless hairs and bristles, anterior tibiae longer than anterior metatarsi, posterior tibiae shorter than posterior metatarsi; *epigynum,* a procurved chitinized slit between posterior lung slits.

Holotype ♀ Dom. Rep.; San Jose de las Matas, 1,500 feet+, June 1938, (Darlington)

The genus *Caponina* is based on the species *testacea* from St. Vincent. The female is only 4.0 mm. long. A year later, Simon described a second species from Venezuela, and in 1899, F.O.P.-Cambridge described a third species from Guatemala. This last species is much larger than the others and has since been found in Costa Rica. The genus has but two eyes, as in *Nops,* but differs in having the labium broader than long, and there is no colorless membrane beneath the anterior metatarsi.

Genus NOPS MacLeay 1838

NOPS COCCINEUS Simon 1891

Nops coccineus Simon, 1891, p. 573, pl. 42, fig. 18. "♂ ♀ St. Vincent"

♂ Haiti; Port-au-Prince, (Crew), Banks Coll.
pullus Haiti; San Marc, January 1913, (Mann)

Family OECOBIIDAE

Genus OECOBIUS Lucas 1845

OECOBIUS AUDANTI spec. nov.

Figures 4, 10, 12

Female. Length, 1.6 mm., ceph. 0.3 mm., long, 0.5 mm. wide, abd. 1.4 mm. long, 0.8 mm. wide.

Cephalothorax pale, with a black marginal band, which widens opposite each coxa by a black dot, sides parallel and above marginal line a row of elongate dark spots, wider than long, anterior margin very broad, and extending in an obtuse point, ocular area very high, shaded in gray, eyes surrounded by black, from black spots above palpi a row of fine long bristles directed towards the eyes, no thoracic groove; *eyes*, a.m.e. and p.l.e. diurnal, round and convex, a.l.e. and p.m.e. flat, white and nocturnal, anterior row procurved, a.m.e. separated by a diameter, slightly larger than a.l.e. and almost touching a.l.e., posterior row slightly longer than anterior row, slightly procurved, p.l.e. largest of the eight, convex, p.m.e. white, flat and triangular, very conspicuous on the base of the black tubercle of p.l.e., p.m.e. separated by more than a long diameter; *clypeus* oblique, higher than eye area; mouth parts pale and weak; *labium* pale brown, longer than wide; *maxillae* pale, inclined over labium; *sternum* pale, wider than long, convex, fourth coxae widely separated; *abdomen* oval, base slightly bilobed, tip pointed, pale, covered with dark spots and dark veins, the largest, an elongate spot that does not reach the middle of the abdomen, venter pale, dark about sides, spinnerets characteristic of the genus; *legs* 4–1–2–3, subequal, pale with dark lateral spots which on ventral side are often broad rings, 2 on femora, 1 on patellae, 2 on tibiae, 2 on metatarsi, few long bristles and a few hairs; *calamistrum* double on middle half of fourth metatarsus; *epigynum*, chitinized area wider than long as figured.

Male. Length, 1.5 mm.

Coloring same as in the female but group of bristles below eyes lacking and eyes more closely grouped; *palpus* as long as cephalothorax, terminal joint large, pale with parts of palpal organ heavily chitinized.

Holotype ♂ Haiti; Port-au-Prince, July 1941, (Audant)
Allotype ♀ Haiti; Port-au-Prince, July 1941, (Audant)
Paratypes 2♂ 7♀ Haiti; Port-au-Prince, July 1941, (Audant)

Oecobius audanti is smaller than *Oecobius benneri* Petr. first found in the University buildings of Rio Piedras, Puerto Rico, and known only from the female. The bristles below the anterior eye row are much longer, and there is a procurved row of six long bristles on the posterior slope of the eye turret. Even when the bristles are broken, the scars are easily seen. The epigynum has a distinct anterior fold, and the openings are much closer together than in the Puerto Rican species. The male palpus resembles that of *O. texanus* Bryant, found in several places in the southern U. S.

While these species are very small and could be easily transported by commerce, it is probable that each island in the Caribbean has an endemic species. Aside from the differences in the epigynum and the palpus, *O. benneri* and *O. audanti* are easily separated by the relative size of the eyes.

Family AMAUROBIIDAE

Genus ALAUXIMUS gen. nov.

Cephalic portion very high, covering about four-fifths of the carapace, anterior margin wide, thoracic groove longitudinal and distinct; *eyes* six, a.l.e. separated by at least two diameters, posterior row procurved, eyes equidistant; *clypeus* narrow; *mandibles* geniculate, boss distinct, fang groove oblique, upper margin with five teeth; *cribellum* bipartite; *calamistrum* a single row of very short hairs; *legs*, 1–4–2–3, not varying greatly in length, femora with ventral trichobothria. Male unknown.

Genotype *Alauximus infumatus* spec. nov.

The genus *Alauximus* differs from other genera in the family in having only three pairs of eyes and by the very high and long cephalic portion.

ALAUXIMUS CRASSUS spec. nov.

Figure 13

Female. Length, 5.1 mm., ceph. 2.0 mm. long, 1.4 mm. wide, abd. 3.0 mm. long, 2.0 mm. wide.

Cephalothorax pale brown, cephalic portion very high, rising gradually to about the middle and then sloping to within about one-sixth of the posterior margin where it falls in a concave slope, anterior margin very little narrowed, with many short hairs, thoracic groove longitudinal and on the posterior slope; *eyes*, three pairs, subequal, on middle half of the head, a.l.e. separated by more than two diameters, posterior row procurved, eyes equidistant, p.m.e. separated by a little more than a diameter, lateral eyes separated by less than a diameter; *clypeus* below a.l.e. less than a diameter of a.l.e., margin fringed with long hairs; *mandibles* brown, strongly geniculate, with a well defined boss, fang groove oblique, upper margin with five equidistant teeth, first two near base of fang small, next two long and sharp, lower margin with one very small tooth, fang evenly curved; *labium* longer than wide, (2.5 : 2.0), with a pit on lateral margins near base, not fused to sternum; *maxillae* one and a half times as long as labium, inner margins parallel; *sternum* brown, with many long hairs, convex, two-thirds as wide as long, tip pointed between posterior coxae, fourth coxae separated by less than a diameter; *abdomen* pale, thickly covered with short hairs, no markings, convex, venter paler, with fewer hairs; *cribellum* directly anterior to the spinnerets, probably divided as the margin of the lobe shows a notch in the middle; *legs*, 1–4–2–3, rather short and not varying greatly in length, same color as cephalothorax, no stripes or dark rings but many hairs, all femora with ventral trichobothria, no scopula on tarsi or metatarsi, spines, I pair, femur, dorsal, 1–1–1, all small, patella, 0, tibia, ventral, 2–2–2, not opposite, metatarsus, ventral, 2–2–2, all small, II pair same as I pair, posterior patellae with a retrolateral spine; calamistrum on prolateral margin of fourth metatarsus, less than half the length of the joint, near base, in a single row of very short, colorless hairs; *epigynum*, two large round sacs beneath the surface, separated by less than half a diameter, openings may be the clear ovals anterior to the sacs.

Holotype ♀ Dom. Rep.; North Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

ALAUXIMUS INFUMATUS spec. nov.

Figure 14

Female. Length, 4.0 mm., ceph. 2.0 mm., long, 1.2 mm. wide, abd. 2.0 mm.

Cephalothorax pale brown, darker about eyes, anterior margin little narrowed, swollen, cephalic portion very high and long, convex, sloping gradually to within a third of the posterior margin where it falls abruptly in a concave slope, thoracic groove short on posterior slope; *eyes*, three pairs, cover middle half of the anterior margin, a.l.e. largest, separated by more than two diameters, posterior row procurved, little longer than anterior row, eyes equidistant and subequal, p.m.e. separated by less than two diameters; *clypeus* below a.l.e. less than a diameter of a.l.e.; *mandibles* vertical, geniculate, boss small, fang groove slightly oblique, impossible to see teeth on upper margin, lower margin with four small equidistant teeth, fang small; *labium* as long as wide, lateral margins near base notched; *maxillae* not quite twice as long as labium, sides parallel; *sternum* more than two-thirds as wide as long, convex, very few hairs; *abdomen* has been injured, pale with dark markings, venter pale with dark lateral stripes; *cribellum* directly anterior to spinnerets; *legs*, I and II right missing, 4–1–2–3, pale, distal joints darker, no scopula on tarsi or metatarsi, spines, I pair, femur, dorsal, median, 1, prolateral, 1 at tip, patella, 0, tibia, ventral, 1 at tip, 1 about middle, 2 at base, prolateral, 2, retrolateral, 1, metatarsus, ventral, 2–2–2, II pair with fewer spines on tibia and metatarsus, posterior pairs, few spines on tibiae and metatarsi; *calamistrum* near base of fourth metatarsus, less than half the length of the joint, a single row of very short colorless hairs; *epigynum*, area wider than long, a wide convex median lobe, basal portion with hairs and tip much narrowed and depressed that reaches the fold, each side of narrow tip are elongate oval openings and above these are large globular sacs beneath the surface that are very conspicuous.

Holotype ♀ Dom. Rep.; north of Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

It is with some hesitation that *Alauximus infumatus* and *A. crassus* are placed in the same genus. Both have but three pairs of eyes and both have the cephalic portion of the cephalothorax very long and high; this is longer in *crassus* than in *infumatus*. Both have the same arrangement of spines on the legs and a calamistrum of very short colorless hairs. But the eyes of *crassus* are subequal and the lower margin of the fang groove has but one small tooth. In *infumatus* the anterior lateral eyes are larger than the others, and there are four teeth on the lower margin of the fang groove.

So far as known, all genera in the family *Amaurobiidae* have four pairs of eyes but in some species of *Auximus*, the a m.e. are much smaller than the others. In the *Dictynidae*, there are several genera in which the a.m.e. have disappeared.

Genus AUXIMUS Simon 1892

AUXIMUS GRATUS spec. nov.

Figure 15

Female. Length, 6.5 mm., ceph. 2.5 mm. long, 2.0 mm. wide, abd. 4.5 mm.

Cephalothorax brown, shining, widest between the second pair of legs, anterior margin only slightly narrowed, cephalic portion long, not separated from the thoracic, moderately high, falls abruptly from the groove, thoracic groove long; *eyes* cover middle half of the anterior margin, anterior row straight, eyes equidistant, a.l.e. more than twice the diameter of a.m.e., posterior row a little longer than anterior, procurved, eyes subequal, p.m.e. separated from p.l.e. by less than a diameter and a half and from each other by a little more, lateral eyes subequal and touching; *quadrangle* much narrower in front and higher than wide; *clypeus* about as wide as diameter of a.l.e.; *mandibles* mahogany-brown, vertical, a distinct boss, fang groove slightly oblique, upper margin with a carina followed by three teeth, lower margin with a row of five small teeth; *labium* brown, not fused to sternum, almost twice as long as wide, sides parallel; *maxillae* brown, about one and a half times as long as labium, sides parallel; *sternum* brown, heart-shaped, three-quarters as wide as long, convex, with a few hairs, not continued between posterior coxae, fourth coxae almost touching; *abdomen* pale brown, vaguely spotted with small darker dots and pale flecks, the latter most numerous about the base, a few scattered hairs about the base, venter same color as dorsum, with no spots, spinnerets at tip, basal pair stout, separated by more than a diameter, two-jointed, distal joint very small, median pair small and slender, dorsal pair little longer than basal pair, very slender, two-jointed with distal joint very short; opening of posterior spiracle very distinct, a narrow pale slit with small, chitinized round openings at each end; *cribellum* notched at middle; *legs*, fourth pair missing, brown, slender, anterior pairs longest, no ventral trichobothria on femora, spines, femora with one median dorsal spine, I pair, patella, 0, tibia, dorsal, 0, ventral, 2–2–2, basal pair very slender, prolateral, 3, retrolateral, 2, metatarsus, dorsal, 0, ventral, 2–2, prolateral, 2, retrolateral, 2, II pair same as I pair; *epigynum* large, wider than long, median area with a heavily chitinized posterior margin, each side with a large transverse pale oval with chitinized margins and anterior to median lobe two pairs of dark sacs beneath the surface.

Holotype ♀ Dom. Rep.; Cordillera Central, Constanza to Jarabacoa, 2,000–4,000 feet, August 1938, (Darlington)

Auximus gratus is probably not a true *Auximus,* but it belongs near *Auximus productus* Chamberlin, which is based on a female from Tincochaca, Peru, at an altitude of 7,000 feet. The genotype, *Auximus dentichelis* Simon was described from both a male and a female from the Azores. Judging by the description, both are small, and the mandibles of the male are abruptly narrowed on the distal third, so that the fang groove is oblique and very long. *Auximus gratus* can not be placed in the genus *Amaurobius,* because of the oblique fang groove which has several teeth on the lower margin.

Family PISAURIDAE

Genus THAUMASIA Perty 1833

THAUMASIA ANNECTA spec. nov.

Figure 18

Female. Length, 10.0 mm., ceph. 6.0 mm. long, 5.1 mm. wide, abd. 6.0 mm. long, 3.2 mm. wide.

Cephalothorax brown, middle area darker, bordered by a pale curved stripe from clypeus to posterior margin, darker portions covered with short dark hairs, anterior margin much narrowed, sides rounded, quite flat, thoracic groove long; *eyes* cover middle half of anterior margin, each eye heavily ringed with black, anterior row slightly procurved, eyes equidistant, a.m.e. larger than a.l.e., separated by a diameter of a.m.e., posterior row strongly recurved, longer than first row, p.m.e. larger than a.m.e., separated by two diameters, p.l.e. larger than p.m.e., placed on a tubercle and directed backward, separated from p.m.e. by fully two and a half diameters of p.m.e.; *quadrangle* narrower in front, and as high as wide behind; *clypeus* vertical, fully as high as quadrangle; *mandibles* brown, with many long bristles, vertical, boss small, fang groove oblique, upper margin with a scopula of long colorless hairs, with three teeth, middle tooth largest, lower margin with three teeth, tooth near base of fang the largest and third tooth quite small and well separated from the other two; *labium* brown, longer than wide, lateral margins on basal half emarginate with a deep chitinized round pit on each side above the base; *maxillae* pale, almost twice as long as labium, parallel; *sternum* pale, with many long hairs, wider than long, (6.0 : 5.0), rebordered, emarginate opposite coxae and the tip continued as a narrow lobe between the fourth coxae; *abdomen* oval, deeply bilobed at base, brown, with a narrow lanceolate darker mark at the base that fades out before the middle, sides striped with dark, a pair of widely separated transverse pale marks about one third from tip and a smaller pair at tip above the spinnerets, venter paler than dorsum; *legs*, 4–1–2–3, III left missing, differing little in length, long and slender with long spines, brown with many short dark hairs, all patellae with distal spine, anterior pairs with a prolateral spine, posterior pairs with prolateral and retrolateral spines, no small ventral apical spine on metatarsi, spines, I pair, tibia, ventral, 2–2–2–2, distal pair very small, other spines long, lateral, 2–2–2, dorsal, 1–1, metatarsus, ventral, 2–2–2, lateral, 2–2–2, dorsal, 0; *epigynum*, area wider than long, slightly convex, covered with short white hairs, so that all structure beneath is obscure, openings widely separated ovals on posterior margin, this margin somewhat rolled under.

Holotype ♀ Haiti; Ennery, 10 September 1934, (Darlington)

Thaumasia annecta is smaller than *Thaumasia marginella* (Koch) from Brazil, and reported from several of the islands of the Caribbean. It also differs from the genotype in the absence of a small ventral apical spine on the metatarsi and the very simple epigynum. The spider has evidently oviposited, as the abdomen is relatively small and shrunken.

Genus TINUS F.O.P.-Cambridge 1902

TINUS CONNEXUS (Bryant)

Figures 17, 19

Thaumasia connexa Bryant, 1940, p. 277, fig. 22. "♀ Cuba; Pico Turquino, 1,500 feet, 25 June 1935, (Darlington)."

Female. Length, 9.1 mm., ceph. 4.5 mm. long, 4.0 mm. wide, abd. 5.0 mm. long, 3.0 mm. wide.

Cephalothorax pale brown, with a paler stripe above the margin from the clypeus to the posterior margin, darker areas covered with short fine dark hairs, almost as wide as long, anterior margin more than half the greatest width, somewhat flattened, thoracic groove long and deep with areas each side rounded; *eyes* cover little more than the middle half, anterior row slightly recurved, a.m.e. little larger than a.l.e., separated by less than a diameter and a little nearer the a.l.e., posterior row recurved so that posterior margin of p.m.e. and anterior margin of p.l.e. form a straight line, eyes heavily ringed with black, subequal, p.m.e. almost twice the diameter of a.m.e., separated by about a diameter and from p.l.e. by a diameter and a half, p.l.e. slightly raised; *quadrangle* of median eyes narrower in front and as high as width of p.m.e.; *clypeus* below a.m.e. fully two diameters of a.m.e., a pair of long slender bristles below a.m.e.; *mandibles* pale brown, covered with white hairs and longer dark bristles, vertical, fang groove oblique, upper margin with three teeth, lower margin with three teeth, the two near base of fang contiguous, third tooth separated, fang longer than groove; *labium* pale, slightly longer than wide, not fused to sternum; *maxillae* pale, more than one and a half times longer than labium, outer margins parallel, with a scopula of long colorless hairs; *sternum* pale, wider than long, (6.0 : 5.0), flat, with a few long hairs, anterior margin only a little narrowed, sides emarginate opposite coxae and ending in a very slender point between the fourth coxae, fourth coxae separated by almost a diameter; *abdomen* brown, with a narrow pale median stripe on basal third, sides mottled with a darker brown, with many pale hairs, venter pale, thickly covered with long white hairs; *legs*, 2–4–1–3, long and slender, (II pair 32.0 mm. long,) varying little in length, no scopula on tarsi and metatarsi, pale, all joints with wide darker bands, spines, all dorsal spines small, patellae with a long dorsal spine at tip, metatarsi with a small apical ventral spine, I pair, tibia, ventral, 2–2–2, and 2 distal very short, prolateral, 3, retrolateral, 3, metatarsus, ventral, 2–2–2, long, 1 small median apical spine, prolateral, 3, retrolateral, 3, II pair same as I pair; *epigynum*, darkened area as long as wide, a median portion twice as long as wide, separated from sides by a darkened groove.

Male. Length, 6.5 mm., ceph. 3.5 mm. long, 3.5 mm. wide, abd. 3.4 mm. long, 2.0 mm. wide.

Cephalothorax the same as the female, but as wide as long; *eyes*, posterior row more recurved than in the female, so the eyes are more widely separated; *clypeus* lower than in the female; *mandibles* pale, small, vertical, fang groove oblique, upper margin with a scopula of long reddish hairs followed by three small teeth, lower margin with three well separated teeth; *sternum* pale, flat, as wide as long, ending in a slender point between the fourth coxae; *abdomen* has been injured, dark and mottled, base bilobed; *legs*, 2–4–1–3, (II leg 30.0 mm. long), much more slender than in the female, spines the same; *palpus* longer than cephalothorax, patella as long as the diameter of the joint with a long dorsal spine at the tip, tibia longer than patella, with a large leaf-like dorsal apophysis with the distal third much constricted in a twisted process and turned retrolaterally, ventral process slender, chitinized and curved, ending in a hook that rests on the base of the bulb, all parts of the palpal organ confined to the cavity, embolus a black ribbon-like piece in the distal half of the cavity that probably forms a circle and a half with a free tip near the middle; the most conspicuous part is a flat disk in the center, which half hides the embolus, with a process from the side superimposed on a longer parallel piece, both protruding from the cavity.

Allotype ♂ Dom. Rep.; foot hills of the Cordillera Central, south of Santiago, 1,000–3,000 feet, June 1938, (Darlington)

♀ Dom. Rep.; foot hills of the Cordillera Central, south of Santiago, 1,000–3,000 feet, June 1938, (Darlington)

The genus *Tinus* was based by F.O.P.-Cambridge on the species *nigrinus* from Central America, a larger species than *connexus*. It differs, also, from the Hispaniola species by the relative length of the legs, (4–2–1–3), and the space between the p.m.e., but the palpi and epigyna are similar.

Family LYCOSIDAE

Subfamily LYCOSINAE

Genus ARCTOSA C. Koch 1848

ARCTOSA TANTILLA spec. nov.

Figure 20

Female. Length, 7.0 mm., ceph. 3.5 mm. long, 2.4 mm. wide, abd. 3.5 mm. long, 2.0 mm. wide.

Cephalothorax brown, with a vague median pale stripe, and indistinct radial striae, black in eye area, entire cephalothorax covered with fine dark hairs, anterior margin slightly more than half the greatest width, widest opposite third pair of legs, sides evenly rounded, moderately high, thoracic groove long and distinct; *eyes* cover middle half of the head, in three rows, anterior row slightly procurved, eyes very small, equidistant, a.m.e. larger than a.l.e., second row as long as anterior row, eyes separated by about a diameter, p.l.e. subequal to p.m.e. and separated by more than two diameters; *quadrangle* of posterior eyes wider behind and higher than wide; *clypeus* equals about a diameter of a.m.e.; *mandibles* dark reddish-brown, geniculate, vertical, with many long hairs, fang groove slightly oblique, upper margin with three teeth, middle tooth largest, lower margin with two small, subequal teeth, fang with a thick base; *labium* longer than wide, basal half of lateral margins notched; *maxillae* pale, twice as long as labium, outer margins parallel, tips not widened; *sternum* pale, convex, almost as wide as long, (3.0 : 3.5), pointed in front of fourth coxae, fourth coxae almost touching; *abdomen* oval, pale with irregular dark marks which form a wide band across the middle, marks more numerous on posterior half, entire abdomen covered with long and short hairs, venter pale; *legs*, I pair missing, [1]–4–2–3, pale with distal joints darker, spines, II pair, patella, 0, tibia, dorsal, 0, ventral, 2–2–2, distal pair short, prolateral, 1, second pair of spines not opposite, and spines of prolateral row more slender than retrolateral row, dorsal basal spine on fourth tibia; *epigynum* with a broad median lobe with margins rebordered and a rounded tip, each side in anterior portion, large openings close to median lobe and posterior to openings are dark sacs beneath the surface.

Holotype ♀ Dom. Rep.; south side of Lake Enriquillo, 10 September 1934, (Darlington)

Paratype ♀ Dom. Rep.; south side of Lake Enriquillo, 10 September 1938, (Darlington)

Arctosa tantilla is much smaller than the genotype, *Arctosa cinerea* (Fabr.) and it has but two teeth on the lower margin of the fang groove. However, in some of the European species of the genus, the third tooth is very small. According to Simon, this species would be placed in *Alopecosa* (Hist. Nat. Araignées, 1898, 2: 336), as it has but two teeth on the lower margin of the fang groove, but the spines are more slender and not so numerous as in the genotype, *Lycosa fabrilis* (Clerck) of Europe. The Hispaniola specimen has probably oviposited, as the venter is shrunken. The paratype is a little smaller, and the dorsal marks are not quite so distinct, but the epigynum is the same.

Genus Lycosa Latreille 1804

Lycosa festina spec. nov.

Figures 11, 22

Female. Length, 13.5 mm., ceph. 7.0 mm. long, 4.5 mm. wide, abd. 7.0 mm. long, 4.5 mm. wide.

Cephalothorax with a narrow pale median stripe from the posterior eye row to the margin, a pale lateral stripe of about the same width from the clypeus and a very narrow marginal dark stripe, the dark stripes covered with dark hairs, white hairs and long bristles about the eyes, anterior margin about half the greatest width, thoracic groove long; *eyes*, anterior row straight, eyes equidistant, a.m.e. larger than a.l.e., second row slightly longer than the first row, eyes separated by little less than a diameter, and from p.l.e. by a diameter and a half; *mandibles* dark brown, vertical, geniculate, fang groove oblique, upper margin with three teeth, one near the base of the fang small, middle tooth largest, lower margin with three subequal, equidistant teeth; *labium* brown, longer than wide; *maxillae* twice as long as labium; *sternum* pale, not so wide as long, (6.0 : 8.0), ending in a point between posterior coxae; *abdomen* with a dark spear-mark on basal half, with a pale stripe at base and sides, tip connected with first chevron, posterior half with several dark chevrons, sides dark, venter pale, with scattered dots; *legs*, 4–1–2–3, right I and II missing, brown, with indistinct dark rings on dorsal side, a heavy scopula on anterior tarsi and metatarsi and a thinner scopula on posterior pairs, spines, I pair, patella, 0, tibia, ventral, 2–2–2, distal pair very small, lateral, 2–2, metatarsus, ventral, 2–2–2, 1 median distal, lateral, 2–2, II pair same as I pair, III and IV tibiae with a dorsal basal spine; *epigynum*, area about as wide as long, cross piece shorter than septum and narrow, septum arched, wider at anterior end than at union with cross piece.

Male. Length, 10.0 mm., ceph. 5.5. mm. long, 4.3 mm. wide, abd. 5.0 mm. long, 3.0 mm. wide.

Cephalothorax and abdomen like female, dark dots on the venter smaller than in female; *legs*, I and II right missing, scopula almost as heavy as in the female and spines longer; *palpus*, patella little longer than diameter of the joint, tibia more than twice as long as patella and fully three-quarters as long as tarsus, palpal organ confined to basal half, parts best understood from figure.

Holotype ♀ Haiti; San Marc, December 1912, (Mann)
Allotype ♂ Haiti; San Marc, December 1912, (Mann)
Paratypes ♀ Haiti; Petionville, November 1912, (Mann)
Paratypes ♀ Haiti; Manneville, December 1912, (Mann)
Paratypes 3♀ 1♂ Haiti; Ennery, January 1913, (Mann)
Paratype ♀ Haiti; Cap Haitien, January 1913, (Mann)
Paratypes ♂ ♀ Haiti; Jacmel, (Mann.)
Paratype ♂ Haiti; Port-au-Prince, (Crew), Banks Coll.
Paratype ♀ Haiti; Ennery, 7 September 1934, (Darlington)
Paratypes 3♀ Dom. Rep.; Puerto Plata, April–July, (Hurst)
Paratype ♀ Dom. Rep.; Puerto Plata, 30 August 1938, (Darlington)

Lycosa festina shows some variation in size. The specimens collected at Puerto Plata in July are smaller than those collected earlier in the year. But all have the same marks, the narrow median pale stripe on the cephalothorax and the dark spear-mark on the abdomen framed at the base and the sides by a distinct pale stripe and the tip of the spear-mark connected to the first dark chevron. The male palpus is unusual in the length of the tibia; in most of the males, the cymbium extends far beyond the palpal organ.

LYCOSA INCONSPICUA spec. nov.

Figure 16

Female. Length, 9.2 mm., ceph. 5.1 mm. long, 3.9 mm. wide, abd. 4.5 mm. long, 3.1 mm. wide.

Cephalothorax with a narrow median pale stripe from the p.m.e. to the posterior margin, each side a wide dark stripe covered with short dark hairs, in the dark areas and parallel to median stripe a faint pale stripe from p.l.e. to about the middle of the cephalothorax, a narrow submarginal pale stripe about as wide as the median stripe, eyes surrounded by black with white hairs between p.m.e., a row of dark bristles below posterior eyes and parallel to margin, and a shorter row posterior to each p.l.e., anterior margin less than half the greatest width, thoracic groove long; *eyes*, anterior row straight, a.m.e. larger than a.l.e. and separated by more than a radius, a.l.e. separated from a.m.e. by a radius of a.l.e., p.m.e. separated by a diameter and p.l.e. separated by fully three diameters; *quadrangle* of posterior eyes wider behind and wider than high; *clypeus* about as high as diameter of a.m.e.; *mandibles* same color as cephalothorax, geniculate, vertical, with many long bristles, fang groove oblique, upper margin with three teeth, tooth nearest the base of fang very small, middle tooth largest, lower margin with three equidistant teeth, middle tooth largest; *labium* pale, longer than wide, lateral margin of basal half excavate; *maxillae* pale, slightly inclined, about twice as long as labium; *sternum* pale, convex, two-thirds as wide as long; *abdomen* brown, with a narrow, pale, basal spear-mark, outlined with a darker brown, venter pale; *legs*, 4–1–2–3, same color as cephalothorax, no dark rings, anterior tarsi and metatarsi scopulate, faint scopula on posterior tarsi, spines, I pair, patella, 0, tibia, dorsal, 0, ventral, 2–2–2, basal and middle pairs slender but as long as the diameter of the joint, prolateral, 1, retrolateral, 0, metatarsus, dorsal, 0, ventral, 2–2, distal, 1 median at tip, prolateral, 1, II pair, spines same as on I pair, III and IV tibiae with dorsal basal spine; *epigynum*, area wider than long, cross piece rather narrow and longer than median septum, openings apparently at anterior end.

Holotype ♀ Haiti; Ennery, 7 September 1934, (Darlington)

Lycosa inconspicua is very similar to *Lycosa atlantica* Marx, but much smaller and more delicate. The specimen has evidently oviposited as the venter is depressed and wrinkled. The median septum is narrower and longer than specimens of *L. atlantica* from Bermuda.

LYCOSA REDUCTA Bryant

Lycosa reducta Bryant, 1942, p. 330, fig. 25. "Virgin Islands, St. Croix, (Beatty)"

The markings are very distinct, and the very short spines on the anterior tibiae are characteristic. The anterior metatarsi are heavily scopulate and have a small median ventral spine at the distal end that was not noted in the original description.

♀ Haiti; La Visite, 6,000–7,000 feet, 16–23 September 1934, (Darlington)

Subfamily PARDOSINAE

Genus PARDOSA C. Koch 1848

PARDOSA PORTO-RICENSIS Banks

Pardosa porto-ricensis Banks, 1901, p. 224, pl. 15, figs. 2, 3. "1 ♀ Porto Rico; San Juan"

1 ♂ Haiti; Trou Caiman, 7 September 1934, (Bates)

Family OXYOPIDAE

Genus HAMATALIWA Keyserling 1887

Hamataliwa Keyserling, 1887, p. 457
Oxyopeidon O.P.–Cambridge, 1894, p. 139

The genus *Hamataliwa* was based by Keyserling on the species *grisea.* Dr. G. Marx had two specimens, probably both females, and he sent one to his friend, Count von Keyserling, with the vague locality, "North America." The type is now in the Keyserling Collection in the British Museum. In 1890, when Dr. Marx published the "Catalogue of the Described Araneae of Temperate North America," he states in a note on p. 592, that he had but two specimens of this species and he gave one to Keyserling. In the text of the Catalogue, Dr. Marx has Florida and Virginia as localities where the species is found.

The Keyserling description is very definite, and *H. grisea* has been identified from Florida, Alabama, Texas and Arizona, but unfortunately later workers have read the generic description very hastily and much confusion has arisen. Keyserling states that the anterior row of eyes is recurved and shorter than the procurved posterior row; the a.m.e. are separated by about a diameter and are two diameters from the a.l.e.

In 1894, O.P.–Cambridge, in the Biol. Centr. Amer., 1: 139, proposed the genus *Oxyopeidon* for seven species from Central America, some based on males, others on females, but he selected no type.

In 1898, Simon (Hist. Nat. des Araignées, 2: 139) redescribed the genus *Hamataliwa* and reduced *Oxyopeidon* to synonymy. While he failed to mention the eyes of the anterior row in the text, in the key, (p. 378), he states, "Oculi quatuor antici inter se appropinquati, lineam angustam valde recurvam (fere Ocypes) designantes."

F.O.P.–Cambridge did not agree with Simon, and in the second volume of the Biol. Centr. Amer., 1902, p. 246, selected the second species described by O.P.–Cambridge as the type of *Oxyopeidon,* as he considered the first species, *O. facile* as a *Hamataliwa.* He stated that the type of *Hamataliwa* was before him and that the anterior eye row was straight.

The matter is further complicated, since Simon in the appendix of the Hist. Nat. des Araignées, (1903), 2 : 1048, uses *Oxyopeidon* O.P.–Cambridge for *Hamataliwa* as defined earlier, and *Hamataliwa* Keys. replaces *Emmenophrys* Simon, 1898, p. 390. The difference between these genera is in the spacing of the eyes of the posterior row, and the curvature of the anterior eye row. According to the figures of O.P.-Cambridge, there is a difference in the spacing of the eyes of the male and female of a given species, and unless some other difference can be found, the genus *Oxyopeidon* must be considered as a synonym of *Hamataliwa* Keys.

Genotype *Hamataliwa grisea* Keyserling.

HAMATALIWA COMMUNICANS (Chamberlin)

Oxyopeidon communicans Chamberlin, 1925, p. 128, fig. 40. "Holotype; M.C.Z., no. 1190, ♀ Haiti; one female, Crew coll."
Hamataliwa grisea Banks, 1903, p. 341, (*nec* Keyserling, 1887)

Holotype ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.
2♀ Haiti; Port-au-Prince, July 1941, (Audant)
♀ Haiti; Post Terre Rouge, 2,000 feet, October 1934, (Darlington)

Hamataliwa communicans can be distinguished from *H. haytiana* by its smaller size, eyes of the anterior row equidistant, and the epigynum wider in proportion to the length, and the openings more widely separated.

HAMATALIWA CUBANA (Chamberlin)

Oxyopeidon cubanum Chamberlin, 1925, p. 128, fig. 41. "Cuba; Santiago de las Vegas, (Baker), N.Banks Coll., M.C.Z. no. 1187, 1 ♀"
Hamataliwa grisea Banks, 1909, p. 167, *nec* Keyserling, 1887

2♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)

♀ Haiti; foot hills 3,000–4,000 feet, north-east Massif de la Hotte, October 1934, (Darlington)

HAMATALIWA HAYTIANA (Chamberlin)

Figures 23, 24

Oxyopeidon haytianum Chamberlin, 1925, p. 127, fig. 39. "Haiti; One female. Crew coll., M.C.Z. no. 1189"
Hamataliwa grisea Banks, 1903, p. 341, *nec* Keyserling, 1887

Female. Length, 9.0 mm., ceph. 4.0 mm. long, 3.0 mm. wide, ant. margin 2.5 mm., abd. 4.6 mm. long, 2.6 mm. wide.

Cephalothorax pale brown, with narrow white scales on sides, between eyes and on clypeus, and longer narrow dark scales on upper surface, sides very little narrowed, very high, rising slightly from posterior eye row to a little beyond the groove where it falls abruptly to posterior margin, thoracic groove long; *eyes*, anterior row strongly recurved, eyes very unequal in size, a.m.e. small, separated by a little more than a diameter and from a.l.e. by more than a diameter of a.l.e., posterior row covers three-quarters of head, procurved, p.m.e. nearer to p.l.e. than to each other, eyes subequal to a.l.e.; *quadrangle* formed by a.l.e. and p.m.e. slightly narrower in front and wider than high; *clypeus* not grooved below anterior eye row, higher than space between a.m.e. and p.m.e., very slightly convex near margin; *mandibles* pale brown, cone-shaped, anterior surface flattened, basal half covered with narrow dark scales, fang groove very short; *labium* pale, almost three times as long as wide; *maxillae* pale, one and a half times as long as labium, upper margin black; *sternum* pale, convex, triangular, widest between first coxae, pointed between posterior coxae; *abdomen* pale, with groups of narrow dark scales, widest near the spinnerets, venter pale; *epigynum*, area wider than long, a pale median plaque, with widely separated openings at anterior margins.

Male. Length, 5.2 mm., ceph. 2.5 mm. long, 2.0 mm. wide, abd. 2.5 mm. long, 1.4 mm. wide.

Cephalothorax and *eyes* same as in female; *abdomen* pale with many white scales; *legs* long with many spines; *palpus* not so long as cephalothorax, tibia a little longer than patella, with many soft white hairs, tibial apophysis bifid with upper branch long, slender and heavily chitinized, tip rubs against the lower chitinized angle of the cymbium, lower branch widely separated from the upper, directed downward, broader than upper with a rounded tip abruptly bent backwards, palpal organ completely fills cavity, embolus very black and heavy, starts on margin above the middle, follows the contour of the cavity and ends just above the origin with a blunt point which rests on a short flattened ribbon-like piece with a truncate tip, many very long white hairs on margin of the cymbium which partly cover the various parts.

Holotype ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

Allotype ♂ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

♂ ♀ Dom. Rep.; Puerto Plata, April–May 1941, (Hurst)

♂ Dom. Rep.; San José de las Matas, 1,500 feet+, June 1938, (Darlington)

♂ Dom. Rep.; foot hills of Cordillera Central, south of Santiago, 1,000–3,000 feet, June 1938, (Darlington)

♀ Dom. Rep.; Cordillera Central, 3,000–4,000 feet, Constanza, August 1938, (Darlington)

HAMATALIWA NIGRITARSUS spec. nov.

Figures 28, 29

Male. Length, 5.0 mm., ceph. 2.4 mm., abd. 2.5 mm.

Cephalothorax pale brown, a few small dark scales on sides, very high, longer than broad, slightly narrowed anterior to posterior row of eyes, sides slightly rounded, thoracic groove long and distinct but not deep; *eyes,* ocular area red with a few white scales between the eyes, anterior row strongly recurved, a.m.e. very small, separated by a little more than a diameter, a.l.e. largest of the eight, separated from a.m.e. by a radius of a.l.e. and from each other by about a diameter and a quarter, posterior row longer than anterior, strongly procurved, eyes subequal, p.m.e. slightly nearer p.l.e. than to each other; *quadrangle* of a.l.e. and p.m.e. as wide behind as in front, longer than wide; *clypeus* not as high as quadrangle, slightly convex, with many small white scales; *mandibles* yellow, with a small dark spot on median margin just above the fang groove, small, cone-shaped, very small boss, two pairs of long colorless parallel bristles on median margin midway between base of fang and fang groove, directed downward, fang groove very short, with a small black tooth on each margin, fang short; *labium* more than twice as long as wide, on each lateral margin about the middle, a deep pit; *maxillae* almost twice as long as labium, not as wide as labium, sides parallel; *sternum* pale, two-thirds as wide as long, ending in a slender lobe between the fourth coxae, flat, no hairs; *abdomen* oval, flat, distal quarter much narrowed, pale with no markings, venter pale; *legs,* 1–2–4–3, differing little in length, pale with terminal joints darker, all tibiae with a long dorsal basal spine; *palpus* about as long as cephalothorax, femur and patella pale, patella shorter than tibia with two dorsal spines, distal spine very long and parallel to basal spine on tibia, tibial apophysis as long as tibia, parallel to cymbium, very long and slender, outer margin black and continued as a chitinous ridge to ventral side where it ends in a short point, cymbium very convex, lower margin with a thick fringe of long white hairs that hides almost half of the palpal organ.

Female. Length, 5.8 mm., ceph. 2.5 mm., abd. 3.2 mm.

Cephalothorax little darker than in the male, thinly covered with narrow dark scales; *eyes* same as in male; *mandibles* large and geniculate, distinct boss, reddish, two pairs of very long dark bristles on median margin midway between base and fang groove, as in the male, fang groove short, small black tooth on each margin; *mouth parts* and *sternum* same as in male; the three terminal joints of palpi dark; *abdomen,* dorsum pale, flat, sides dark and thinly covered with dark scales, abdomen almost pentagonal, widest in posterior third, when it suddenly narrows, venter pale, with many short hairs; *legs,* I right and I and II left missing; *epigynum* of the usual type, but the median plate very broad, posterior to the dark openings are a pair of small hyaline sacs below the surface.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Allotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Hamataliwa nigritarsus is separated from other species of the genus, by the two pairs of long parallel bristles on the mandibles and the very long tibial apophysis of the male palpus. The female is separated from others by the two pairs of bristles on the mandibles and the very broad median plate of the epigynum. *H. tuberculata* (Chamberlin) also has the abdomen very wide on the posterior third, but the type is a female, probably two moults from maturity from Santiago de las Vegas, Cuba and as the relative position of the various parts often change with each moult, it is not very satisfactory to compare specimens from another locality.

Genus OXYOPES Latreille 1804

OXYOPES CREWI spec. nov.

Figures 21, 26, 27

Oxyopes salticus Banks, 1903, p. 341, *nec* Hentz, 1845

Female. Length, 6.0 mm., ceph. 2.1 mm. long, 1.6 mm. wide, abd. 3.6 mm. long, 2.5 mm. wide.

Cephalothorax pale brown, with a pair of parallel broken stripes of dark scales from p.m.e. to posterior margin and broader broken lateral stripes covered with dark scales, cephalothorax very high, almost level posterior to eyes until a short distance from the margin when it drops in almost a vertical slope to the posterior margin, thoracic groove faint and short, anterior margin very little narrowed; *eyes,* all but the a.m.e. heavily ringed with black, anterior row recurved so that a.l.e. is almost posterior to a.m.e. very small, separated by fully two diameters, a.l.e. separated by a diameter and a half and slightly largest of the eight, posterior row longer than the anterior, procurved, eyes subequal and equidistant, a mass of white hairs between eyes of anterior row; *quadrangle* very narrow in front and much higher than wide; *clypeus* not as high as quadrangle, slightly convex, pale, with two parallel black lines from a.m.e. to margin; *mandibles* pale, each with a narrow longitudinal black line that does not reach the fang groove, vertical, cone-shaped, boss small, fang groove very short, one small black tooth on lower margin; *labium* pale, more than twice as long as wide; *maxillae* pale, one and a half times as long as labium, parallel; *sternum* wider than long, widest between I and II coxae, ending in a point in front of fourth coxae, pale, with an irregular black spot opposite the first three coxae; *abdomen* oval, dorsum rounded, pale with a basal spear-mark outlined with dark and broken dark lines on the sides which form a dark mass, venter pale, with a broad dark stripe slightly narrowed above the spinnerets, anterior margin indented with a pair of short pale points; *legs*, 1–2–4–3, pale, all femora with a ventral black line; *epigynum*, area longer than wide, a median pointed finger turned towards the pedicel, convex, with a blunt tip which is rolled under, two widely separated dark sacs beneath the surface at base; seen from the side are two large openings.

Male. Length, 4.3 mm., ceph. 2.0 mm. long, 1.6 mm. wide, abd. 2.2 mm. long, 1.0 mm. wide.

Cephalothorax pale brown, a pair of short dark lines below the a.m.e. and a few dark scales about the posterior margin, otherwise the same as in the female; *eyes, clypeus* and *mandibles* same as in the female; *sternum* with very small black dots; *abdomen* oval, widest at base and pointed above the spinnerets, basal spear-mark dark, bordered on sides by a narrow pale stripe, sides brown, venter with a broad dark stripe from fold to spinnerets; *legs*, 1–2–4–3, femora with black ventral line, heaviest on anterior pairs; *palpus* not as long as cephalothorax, terminal joint very dark, with outer lower margin produced in a triangular flattened lobe with heavily chitinized margins, patella not as long as tibia with no ventral fringe of stiff hairs, ventral apophysis of tibia covers entire surface of anterior portion heavily chitinized and protruding, a small apophysis below the large lobe of the cymbium, embolus follows contour of the cavity and ends in a flattened ribbon near the tip, below the tip a small black point and nearer the tip at one side a larger dark hook that projects from the plane and is best seen in a lateral view.

Holotype ♂ Haiti; Port-au-Prince, (Crew), Banks Coll.

Allotype ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

Paratypes 1♂ 3♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

Oxyopes crewi can be separated from *Oxyopes salticus* Hentz, found in the southern part of the United States and reported from various islands of the Caribbean, by the lack of ventral fringe of stiff hairs on the patella of the palpus and the shape of the ventral ridges on the tibia.

Genus PEUCETIA Thorell 1870

PEUCETIA VIRIDANS (Hentz)

Oxyopes viridans Hentz, 1845, p. 195, pl. 17, fig. 2: reprint, p. 46, pl. 7, fig. 2. "♀ North Carolina, Alabama."

♀ Haiti; hills near Port-au-Prince, 5 September 1934, (Darlington)
♀ Dom. Rep.; Puerto Plata, April–May 1941, (Hurst)
♂ Haiti; Port-au-Prince, (Mann)

Family SICARIIDAE

Genus DRYMUSA Simon 1891

DRYMUSA SIMONI spec. nov.

Figures 25, 30, 31, 32, 33, 35

Male. Length, 6.0 mm., ceph. 3.0 mm. long, 1.6 mm. wide, abd. 3.1 mm. long, 2.0 mm. wide.

Cephalothorax brown, median area pale with a dark lanceolate stripe each side forming a dark V anterior to the thoracic groove, not very high, highest at posterior third, anterior third abruptly narrowed, a short thoracic groove on posterior slope; *six eyes*, in three widely separated groups, differing little in size, median eyes oval and almost touching, lateral eyes round and touching; *clypeus* convex, and about three times the diameter of the median eye; *mandibles* brown, vertical, long, and slightly divergent, fang groove short; *labium* brown, not fused to the sternum, one and a half times as long as width at the base, tip narrowed to one third width at the base, emarginate, lateral margins at distal third abruptly notched; *maxillae* brown, narrow, inclined over labium, but tips not touching, tips reach the fang groove, palpi inserted at basal third; *sternum* brown, convex, no hairs, almost as wide as long, (3.5 : 4.9), anterior margin straight and broad, fourth coxae separated by almost a diameter by a truncate lobe of sternum; *abdomen* oval, base high, pointed above spinnerets, with a narrow dark median stripe and diagonal dark bars each side that connect with median stripe, sides dark, venter dark with fold posterior to the middle and extending across the abdomen, slightly anterior to the spinnerets a median longitudinal compressed lobe or vent with heavily chitinized margins that protrudes from the surface, this may be the opening of the posterior spiracle, spinnerets short and retracted, no colulus; *legs*, 1–2–4–3, fairly long, and slender, brown, with three indistinct white bands on the tibiae, more distinct on posterior pairs than on the anterior, very few hairs, smooth shining, anterior metatarsi and tibiae with a ventral row of recurved hairs, suggestive of *Leucauge*, a few spines on posterior tibiae, tarsi short, three claws from a distinct onychium; *palpus* not as long as cephalothorax, femur curved with no ventral spine but a depressed area with three low roughened spots, patella short, little longer than wide, tibia more than twice as long as patella, thickened with a ventral row of coarse hairs, tarsus about the length of the patella, bulb inserted in a depression at tip, spherical, with embolus at distal end, embolus straight, about as long as bulb, tip abruptly narrowed and bent.

Holotype ♂ Haiti; La Hotte, 5,000–7,800 feet, 16–17 October 1934, (Darlington)

Paratypes 2♀ pullus Haiti; La Hotte, 5,000–7,800 feet, 16–17 October 1934, (Darlington)

Paratype ♀ Haiti; foot hills north-east of La Hotte, 3,000–4,000 feet, October 1934, (Darlington)

The genus *Drymusa* was based on a species from St. Vincent, known only from one female. Later in the Histoire Naturelle des Araignées, 1, p. 278, Simon added another species to the genus, also a female, from the Cape of Good Hope. The genus is separated from *Scytodes* by the much higher clypeus and the short thoracic groove.

The male palpus differs from that of *Scytodes* in the position of the bulb, which is inserted at the end of the tarsus as in the genera *Loxoscelles* and *Plectreurys*, and also in the roughened areas on the femur, rather than a short spine. *Drymusa* also differs from the latter genus in having only three pairs of eyes, the broad posterior lobe of the sternum and the three claws on the tarsus.

The two immature females found with the holotype male on La Hotte, are about half grown and show no indications of the median lobe or vent just anterior to the spinnerets, but this lobe is well developed in the female found in the foothills of La Hotte. This specimen may be one moult from maturity. All the females have the two dark marks on the cephalothorax which form a V anterior to the thoracic groove that Simon describes in the genotype. He made no mention of the curious lobe at the opening of the posterior spiracle. This probably corresponds to the thickened lobe found in some of the male *Salticidae* on Hispaniola, and also found by both O.P.-Cambridge and Chickering on a few species of *Clubionidae* of Central America.

Genus SCYTODES Latreille 1804

SCYTODES FUSCA Walckenaer

Scytodes fusca Walckenaer, 1837, 1: 272. "♂ ♀ Guiane; Cayenne."

♀ Haiti; Port-au-Prince, (Crew), Banks Coll.
♀ Haiti; Cap Haitien, January 1913. (Mann)
♀ Haiti; San Marc, January 1913, (Mann)

SCYTODES HEBRAICA Simon

Scytodes hebraica Simon, 1891, p. 568, pl. 42, fig. 14. "♀ St. Vincent"

♂ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

SCYTODES LONGIPES Lucas

Scytodes longipes Lucas, 1845, p. 71, pl. 1, fig. 2. "♂ Mexique"

♀ Haiti; Momance, November 1912, (Mann)
♂ Haiti; Petionville, November 1912, (Mann)
♀ pullus Haiti; San Marc, January 1913, (Mann)
♀ Haiti; Grand Riviere, January 1913, (Mann)
♀ Haiti; Port-au-Prince, January 1913, (Mann)
♀ Haiti; Miragoane, 2 November 1934, (Darlington)
♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)

Family PHOLCIDAE

Key to Hispaniolan genera of Pholcidae

1. Sternum ending in a point between the posterior coxae. . . . . *Artema*
   Sternum broadly truncate between posterior coxae. 2

2. Posterior row of eyes seen from above procurved............*Blechrosceles*
   Posterior row of eyes seen from above recurved......................3
3. Eyes on a turret, a.m.e. very small........................*Modisimus*
   Eyes not on a turret, a.m.e. and a.l.e. contiguous, a.m.e. only slightly smaller than a.l.e...................................*Physocyclus*

Genus ARTEMA WALCKENAER 1837

ARTEMA ATLANTA Walckenaer

Artema atlanta Walckenaer, 1837, p. 656. "♂ ♀ Nouveau-Monde Amer. merid. ——— Du Bresil."

♀ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

Genus BLECHROSCELIS Simon 1893

BLECHROSCELIS SERRIPES Simon

Figure 46

Female. Length, 7.0 mm., ceph. 2.5 mm. long, 2.5 mm. wide, abd. 5.5 mm. long, 2.5 mm. wide.

Cephalothorax pale, ocular turret dark with a long narrow pale stripe from a.m.e. to groove, a broad dark stripe above lateral margins to posterior margin, ocular turret not high, thoracic groove long and deep; *eyes*, anterior row straight, a.m.e. minute, touching, separated from a.l.e. by more than a diameter, a.l.e. and p.l.e. subequal, posterior row procurved, p.m.e. slightly smaller than p.l.e., separated by fully two diameters, area between a.l.e. and p.l.e. black; *clypeus* fully three times as high as ocular area, inclined; *mandibles* brown, vertical, cone-shaped; *labium* brown, wider than long; *maxillae* brown, one and a half times as long as labium, tips almost touching, palpi inserted very near the base; *sternum* brown, wider than long, (6.5 : 4.5), widest between anterior coxae, strongly rebordered, truncate at tip, fourth coxae separated by a diameter; *abdomen* cylindrical, a pale blue-green with scattered short hairs, no markings, venter same color as dorsum and hairs longer, spinnerets closely grouped: *legs* much broken, very long, tarsi short and pale, all femora with a dorsal and a ventral row of short stiff spines, tibiae with a dorsal row of spines; *epigynum* brown, large, two-thirds as wide as long, with middle area strongly convex and posterior margin about the middle of the venter.

2 ♀ Dom. Rep.; Puerto Plata, April–May 1941, (Hurst)

♀ pullus Dom. Rep.; Villa Altagracia, July 1938, (Darlington)

The original description of *Blechroscelis serripes* Simon, has not been seen, but in the Histoire Naturelle des Araignées, 1893, vol. 1, p. 479, the species is reported from San Domingo. The rows of small spines on the femora and tibiae are mentioned as a specific character. The procurved row of the posterior eyes is a generic character.

Genus MODISIMUS Simon 1893

MODISIMUS FEMORATUS spec. nov.

Figures 39, 42

Male. Length, 2.3 mm., ceph. 0.8 mm. long, 0.9 mm. wide, abd. 1.5 mm. long.

Cephalothorax pale, ocular turret darker, thoracic groove long and deep; *eyes* eight, anterior row straight, a.m.e. punctiform, a.l.e. largest of the eight, separated by less than a diameter, posterior row seen from above straight, eyes subequal, p.m.e. separated by less than a diameter, about touching p.l.e.; *clypeus* high, with a long setiform spur, arising above the margin and almost reaching the fang groove; *mandibles* pale, vertical, distal two-thirds excavate on median margin and paler than basal third, with a large blunt tooth in the median margin, fang groove horizontal; *labium* brown, fused to sternum, wider than long; *maxillae* inclined over labium; *sternum* pale brown, convex, wider than long, posterior coxae widely separated; *abdomen* oval, blue-green with a pair of converging darker stripes that unite about the middle, venter pale, epigastric plate chitinized and extending beyond the middle, followed by a dark spot, anterior to the spinnerets a smooth chitinized plate, not quite as long as the epigastric plate, almost touching the dark spot; *legs* much broken, first pair with a dark ventral stripe on femur and tibia, a ventral row of cusps on distal half, each bearing a short spine, no spines and few hairs on legs; *palpus*, femur with a short spur at distal end, patella short, tibia more than twice as long as patella, tarsus with three short lobes, each bearing long bristles and a long lobe with no spur that protects the embolus, bulb very large.

Holotype ♂ Dom. Rep.; Sanchez, July 1938, (Darlington)

The long setiform spur on the clypeus is very similar to the one figured on *Hedypsilus culcinus* Simon from Venezuela.

Modisimus fuscus spec. nov.

Figures 34, 36, 37, 45

Male. Length, 2.5 mm., ceph. 1.1 mm. long, 1.3 mm. wide, abd. 1.5 mm. long, 1.4 mm. high.

Cephalothorax wider than long, thoracic groove long and deep, ocular turret rather low, posteriorly sloping to the groove, slope dark with numerous long bristles directed forward; *eyes* eight, each surrounded by a heavy dark ring, anterior row straight, a.m.e. minute and touching, a.l.e. largest of the eight, separated from a.m.e. by about a diameter, posterior row seen from above straight, eyes subequal, p.m.e. separated by about two diameters and from p.l.e. by a radius; *quadrangle* higher than wide and very narrow in front; *clypeus* very high, slightly concave; *mandibles* brown, vertical, more than half as long as clypeus, a median lobe on basal third with heavily chitinized inner margins, distal third excavate; *labium* brown, wider than long; *maxillae* inclined so that tips touch above labium; *sternum* brown, wider than long, (6.0 : 4.0), posterior coxae separated by almost two diameters; *abdomen* oval, base very high, brown with many darker stiff hairs, venter pale, fold nearer spinnerets than to pedicel; *legs*, brown, femora with three wide pale rings, I tibia with a ventral row of recurved hairs; *palpus*, tibia not as wide as in *M. vittatus*, tarsus not divided into numerous lobes, embolus a long, rather slender chitinized spur at tip.

Female. Length, 2.5 mm., ceph. 1.1 mm. long, 1.2 mm. wide, abd. 1.6 mm. long, 1.5 mm. high.

Cephalothorax and *eyes* as in male; *mandibles* brown, not modified, vertical; *abdomen* grayish-green mottled with a darker green, with scattered short stiff hairs; *legs* brown, banded with a paler brown, femora and tibiae with three broad pale bands each; *epigynum* very near spinnerets, triangular, broader than long, with lateral margins chitinized, basal margin with many short hairs, midway between epigynum and pedicel four very long bristles, each side that almost meet in the middle.

Holotype ♂ Haiti; Kenskoff, 4,500 feet, 12 November 1934, (Darlington)

Allotype ♀ Haiti; La Visite, 6,000–7,000 feet, 16–23 September 1934, (Darlington)

Modisimus fuscus is probably related to the genotype, *Modisimus glaucus* Simon, based on females, 4.0 mm. long, from San Domingo and St. Thomas. Simon's description is brief, with no mention of the number of eyes, but an exact description of the number of spots on the dorsum. In the Histoire Naturelle des Araignées, 1893, vol. 1, p. 484, Simon figures the palpus of *M. glaucus*, the ocular turret and the front of the mandibles, but still fails to mention the number of eyes. The figure of the palpus shows a short and very broad femur and the figure of the right mandible shows an oblique carina with spicules near the margin of the clypeus.

MODISIMUS GLAUCUS Simon

Figures 38, 41, 56

Modisimus glaucus Simon, 1893, p. 322. "♀ San Domingo et St. Thomas"

Male. Length, 3.0 mm., ceph. 0.9 mm. long, 1.1 mm. wide, abd. 2.0 mm.

Cephalothorax pale with darker radial striae, sides rounded, thoracic groove very long and deep; *eyes* on a turret, rather closely grouped, a.l.e. largest of the eight, separated by a scant diameter, a.m.e. punctiform, almost touching, posterior row straight, p.m.e. smaller than p.l.e., separated by a diameter and a half and from p.l.e. by less than a diameter; *clypeus* higher than eye turret; *mandibles* vertical, on basal third near the median margin, a rather large swelling with an oblique carina edged with a row of short black spicules; *labium* wider than long, fused to sternum; *maxillae* pale, more than twice as long as labium, inclined so that tips almost meet; *sternum* wider than long, with a broad pale stripe from tip of labium to posterior margin, sides brown, posterior coxae separated by more than two diameters; *abdomen* oval, base high, with a pale cross stripe near the base, sides thickly covered with dark olive-green dots, venter pale, with a rectangular green spot posterior to the fold; *legs* much broken, brownish, darker at tips of tibiae; *palpus*, femur with two ventral processes, a small one near trochanter where the joint is narrow and the second near the tip, very much larger, where the joint is half as wide as long, patella narrow, tibia fully twice as long as wide, cymbium at base about as wide as patella, with two small lobes and a long process ending in a slender point with a small pointed lobe near the tip, bulb very large, embolus a slender black tip which rests against the base of the femur.

Female. Length, 2.5 mm.

Cephalothorax and eyes same as in the male, no swelling or carina on mandibles; *sternum* same as in male; *abdomen* oval, base high, pale with three pairs of dark green dots followed by a transverse paler bar, distal part with many dark dots each side of the median pale stripe, venter pale with a rectangular dark spot posterior to the epigynum; *legs* much broken; *epigynum* area wider than long, strongly convex, posterior margin slightly concave with a chitinized point each side.

♂ ♀ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

Simon (Histoire Naturelle des Araignées, 1, p. 484) figured the male palpus, eyes and mandibles. Unfortunately, he depended upon the figures of the palpus for the description and the femur is foreshortened so that the basal apophysis is hidden, for he states that the femur is wider than long and has but one apophysis.

Petrunkevitch in his description of *Modisimus sexoculatus* from Puerto Rico, notes and figures the epigynum with two eggs protruding. This probably is a generic character, as several of the females of *M. glaucus* have two eggs appearing from the epigynum. The eggs are large compared to the size of the spider.

The specimens described are smaller than the female type, but the male agrees with the figures mentioned above.

MODISIMUS VITTATUS spec. nov.

Figures 40, 43, 44

Male. Length, 3.2 mm., ceph. 1.4 mm. long, abd. 2.1 mm. long, 1.5 mm. high.

Cephalothorax pale, wider than long, two pairs of lateral striae, thoracic groove long and deep, ocular turret gray, high, sides parallel; *eyes* six, each heavily ringed with black, a.l.e. largest, separated by more than a diameter, posterior row seen from above, straight, eyes subequal, p.m.e. separated by more than a diameter and from p.l.e. by a radius, lateral eyes separated by more than a diameter of a.l.e., two divergent rows of bristles between the eye rows; *clypeus* pale, with a median dark stripe from turret to margin, very high, concave below the turret and then inclined foreward; *mandibles* small, vertical, with short dark hairs, a mass of dark spicules above fang groove; *labium* wider than long; *maxillae* twice as long as labium and touching the fang; *sternum* with two broad dark stripes from labium to posterior margin, wider than long, (6.0 : 4.0), posterior coxae separated by more than a diameter; *abdomen* oval, base very high, a dark grayish-green, basal half with two pairs of dark spots, the basal pair smaller, posterior portion with a transverse pale bar meeting five narrow pale longitudinal stripes, venter pale green, epigastric fold posterior to the middle; *legs* very long, brownish, first femur with two parallel ventral rows of short spicules, second femur with a single row of spicules; *palpus,* femur with a distal lobe, trochanter with a very long trichobothria, bulb large and globular.

Female. Length, 2.5 mm., ceph. 1.0 mm. long, 1.0 mm. wide, abd. 1.6 mm. long.

Cephalothorax pale, ocular turret high and dark, thoracic groove long, deep and dark; *eyes* six, each heavily ringed with black, a.l.e. largest of the six, separated by about a diameter, posterior row seen from above straight, eyes subequal, p.m.e. separated by about a diameter and from p.l.e. by a radius; *clypeus* with a broad dark stripe from turret to margin, concave; *mandibles* vertical; *sternum* wider than long, with a pale median stripe; *abdomen* blue-green, oval, basal half very high, basal third with dark spots, followed by a cross line of blue with five narrow blue longitudinal lines to posterior part of the abdomen, venter pale, with a median dark spot; *legs* much broken; *epigynum* quite near to spinnerets, convex with widely separated openings, with two long bristles each side, directed towards the middle.

Holotype ♂ Haiti; Port-au-Prince, 1–5 September 1934, (Darlington)

Allotype ♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)

While the male and female were not found together, they have several characters in common that are not found in other species in Hispaniola, such as the dark stripe on the clypeus, the narrow pale stripe on the sternum, and the five pale stripes on the posterior portion of the abdomen. The epigynum is quite distinct from other members of the genus found on the island.

Genus PHYSOCYCLUS Simon 1893

PHYSOCYCLUS GLOBOSUS (Tacz.)

Pholcus globosus Taczanowski, 1873, p. 105. "3 ♀ Cayenne"

♂ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)
♂ ♀ Haiti; Port-au-Prince, July 1941, (Audant)

Family DICTYNIDAE

Genus DICTYNA Sundevall 1853

DICTYNA GUANICA Gertsch

Figure 61

Dictyna parietalis Petrunkevitch, 1930, p. 163, figs. 1, 2, 3; *nec parietalis* O.P.-Cambridge, 1896.

Dictyna guanica Gertsch, 1946, p. 12. "♀ Guanica, Puerto Rico, June 17, 1915."

Female. Length, 2.6 mm., ceph. 1.1. mm., abd. 2.0 mm.

Cephalothorax brown, with long white hairs in the ocular area, cephalic portion elevated, strongly convex, radial striae faintly indicated; *eyes* about cover the anterior margin, anterior row slightly recurved, eyes subequal, a.m.e. convex, separated by little more than their diameter and from a.l.e. by less, posterior row about straight, eyes subequal and equidistant, lateral eyes touching; *quadrangle* slightly narrower in front and wider than high; *clypeus* little higher than quadrangle; *mandibles* brown, vertical, excavate on median area; *labium* dark brown, triangular; *maxillae* pale, almost surrounding the labium; *sternum* brown, convex, almost as wide as long, bluntly pointed between fourth coxae; *abdomen* oval, pale, with a fine dark net-work and covered with small dark hairs, a pair of indistinct dark stripes on posterior half, venter with an indistinct dark median stripe; *legs*, pale, with many dark hairs; *calamistrum* on middle four-fifths of the fourth tarsus; *cribellum* entire, wide; *epigynum*, area wider than long, a pair of oblique, widely separated openings ending in an undulating chitinized ridge with small and less conspicuous openings anterior to the ridge.

♀ Haiti; swamps north of Dessalines, 11 September 1934, (Darlington)

The specimen from Dessalines agrees with the description given by Petrunkevitch, as the epigynum has the same undulating chitinized margins from the widely separated oval openings, and the second pair of openings are anterior to the ridge.

Family THERIDIIDAE

Subfamily ASAGENINAE

Genus COLEOSOMA O.P.-Cambridge 1882

COLEOSOMA FLORIDANA Banks

Coleosoma floridana Banks, 1900, p. 98. "♂ Florida"

Coleosoma blandum Keyserling, *nec* Cambridge, 1884, p. 212, pl. 10, fig. 127, "♂ Florida; Enterprise"

Theridion interruptum Banks, 1908, p. 205, fig. 9. "♀ pullus, Florida; Miami, (Comstock)"

Lithyphantes oophorus Petrunkevitch, 1930, p. 170, figs. 8, 9. "♂ Puerto Rico; field near Aguas Buenas."

Coleosoma floridanum, Bryant, 1944, p. 54, figs. 3, 6.

♂ Haiti; Diquini, (Mann)
♀ Haiti; Ennery, 10 September 1934, (Darlington)
♂ Haiti; Grand Rivière, January 1913, (Mann)
♀ Haiti; Trou Caiman, 15 November 1934, (Darlington)
♂ ♀ Dom. Rep.; Puerto Plata, 30 August 1938, (Darlington)
♂ Dom. Rep.; San José de las Matas, 1,500+ feet, June 1938, (Darlington)

Genus CRASPEDISIA Simon 1894

CRASPEDISIA SPATULATA spec. nov.

Figures 47, 48

Male. Length, 2.5 mm., ceph. 1.4 mm. long, 1.1. mm. wide, abd. 1.4 mm.

Cephalothorax brown, more than three-quarters as wide as long, cephalic portion very high, with a pale horn projecting forwards from the clypeus, lateral margins roughened, radial striae distinct and marked near the margins by rows of small corrugations, thoracic groove punctiform and very near the posterior margin, a median row of four bristles just anterior to the groove, each bristle from a distinct pit, three long bristles each side of the horn directed forward and three pairs of bristles on anterior margin of the horn; *eyes* cover two-thirds of the anterior margin, seen from above, anterior row slightly recurved, eyes equidistant, a.m.e. convex, largest of the eight, separated by a scant diameter, a pair of small bristles between, a.l.e. slightly smaller than a.m.e., posterior row little longer than anterior, procurved, eyes subequal and equidistant, p.m.e. flat, lateral eyes touching; *quadrangle* of median eyes narrower in front and wider behind than high; *clypeus* very high, about the length of the mandibles and two or three times as high as the quadrangle, vertical, anterior horn projects forward and the tip turns down, either side are stiff bristles; *mandibles* brown, vertical, not quite as long as clypeus is high, fang groove horizontal; *labium* brown, an equilateral triangle with tip rounded; *maxillae* one and a half times as long as labium, inclined, with broad tips, palpi inserted at lower half; *sternum* pale brown, triangular, as wide as long, strongly convex, with scattered long bristles, each from a corneous pit, tip a broad lobe that continues between the fourth coxae; coxae pale, anterior pairs elongate, posterior pairs distinctly globular; *pedicel* short, very broad and starting above the posterior margin; *abdomen* a dark clouded brown, oval, a median basal pale spot followed by three pairs of widely separated pale spots, very suggestive of the markings of *Lithyphantes septemmaculatus* Keys., muscle spots distinct, anterior pair very large and smooth, posterior pair smaller, entire dorsum with many bristles, each from a pit, a corneous ring at the base, narrow on the dorsum and fitting over the pedicel and on venter expanding in a broad convex shield that extends more than half way to the spinnerets, spinnerets short, closely grouped and surrounded by a dark ring; *legs*, 4–1–2–3, anterior pairs brown, posterior pairs with wide brown bands at each end of femora and tibiae, no spines but rows of bristles, anterior femora with ventral rows of distinct granules, fourth tarsus with a comb of 4 or 5 curved bristles; *palpus* about as long as cephalothorax, femur long, patella longer than tibia, cymbium longer than patella plus tibia, palpal organ with many small chitinized parts.

Holotype ♂ Dom. Rep.; Cordillera Central, rain forest near Valle Nuevo, 6,000 feet, August 1938, (Darlington)

Paratype ♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

The genus *Craspedisia* was based on the male of *Umfila cornuta*

Keys. from Neu Freiburg, Brazil. Simon had a male and female from Venezuela of what he considered this species when he wrote the description of the genus in the Histoire Naturelle des Araignées, 1, p. 580. Some few discrepancies, however, exist between the Keyserling and the Simon descriptions, so it is possible that Simon had a second species.

Craspedisia spatulata differs from the description of *Craspedisia cornuta* in the grouping of the eyes. The Keyserling species is described as having both rows of eyes recurved and the anterior median much the largest. But both species have a peculiar horn on the clypeus and a corneous ring at the base of the abdomen. The figure of the palpus of *C. cornuta* is small and rather vague, so that it is difficult to trace the parts. The shape of the horn is probably specific. Both Simon and Keyserling figure the lateral view only and the horn appears as a long narrow slender process with the tip abruptly turned downward. In *C. spatulata* the horn is quite broad, shorter, with a truncate tip that only slightly rolls down.

The paratype of *C. spatulata* has nine pale spots on the abdomen, a median row of three, and three on each side, but it differs in no other way from the type.

Genus LITHYPHANTES Thorell 1870

LITHYPHANTES SEPTEMMACULATUS Keys.

Lithyphantes septemmaculatus Keyserling, 1884, 1, p. 141, pl. 6, fig. 88. "♀ Florida; Enterprise." Bryant, 1945, p. 204, figs. 7, 9. "♂ Florida; Winter Park, April 1934."

♀ Haiti; San Marc, January 1913, (Mann)
♀ Haiti; Ennery, 7 September 1934, (Darlington)
♀ Dom. Rep.; south side of Lake Enriquillo, 11 September 1934, (Darlington)

Genus TEUTANA Simon 1881

TEUTANA MODESTA spec. nov.

Figures 49, 51

Female. Length, 5.8 mm., ceph. 2.6 mm., abd. 3.9 mm.

Cephalothorax light brown, shining, few hairs, rather low, anterior margin narrowed, radial striae distinct, thoracic groove a semicircular depression; *eyes* cover two-thirds the width of anterior margin, anterior row recurved, eyes equidistant and subequal, posterior row straight, eyes larger than first row, eyes equidistant, p.l.e. slightly larger than p.m.e., lateral eyes touching; *quadrangle* of median eyes, same width in front as behind; *clypeus* convex, higher than quadrangle, with a few long hairs; *mandibles* cone-shaped, vertical; *labium* much wider than long, same width at tip as at base; *maxillae* more than twice as long as labium, sides parallel; *sternum* triangular, almost as wide as long, (4.0 : 5.0), convex, pointed between fourth coxae; *abdomen* oval, dark brown, covered with short bristles, with two median transverse pale spots, basal and about the middle, followed by a third not as distinct, venter, dark brown, with a pair of broken converging pale stripes; *legs*, 1–4–2–3, light brown, covered with fine hairs, comb on fourth tarsus of nine graduated bristles; *epigynum*, area longer than wide, separated by a median septum, narrow at the base and widening to about twice the width at base, each side below the surface are large dark sacs.

Holotype ♀ Dom. Rep.; Cordillera Central, Valle Nuevo, south east of Constanza, 7,000 feet, August 1938, (Darlington)

Teutana modesta is much smaller than *Teutana grossa*, the European species found about houses in Florida and the west coast of both North and South America. The epigynum of this species has the median septum much narrower with parallel sides.

Subfamily LATRODECTINAE

Genus DIPOENA Thorell 1870

DIPOENA MOROSA spec. nov.

Figures 50, 52, 53

Male. Length, 1.6 mm., ceph. 0.6 mm., abd. 1.1 mm.

Cephalothorax dark brown, short, almost as wide as long, ocular area raised so that the height at the eyes almost equals the entire length, thoracic groove long, on posterior slope of ocular turret, radial striae very faint; *eyes*, anterior row seen from the front, procurved, a.m.e. largest of the eight, projecting forwards, separated by more than a diameter and from a.l.e. by a little more than a line, lateral eyes touching, on a low tubercle, a.l.e. smaller than p.l.e., posterior row very slightly recurved, p.m.e. round, separated by more than a radius and from p.l.e. by more than a diameter and a half; *quadrangle* of median eyes wider in front, and wider than high; *clypeus* inclined forward, fully three times as high as quadrangle; *mandibles* brown, small, cone-shaped and weak, fang groove short; *labium* wider than long, tip pointed; *maxillae* strongly inclined with tips almost touching; *sternum* brown, smooth, convex, triangular, carried between fourth coxae in a lobe that almost reaches pedicel; *abdomen* globose, almost as wide as long, (3.5 : 4.5), brown, covered with white spots, a darker median stripe can be traced, venter dark brown; *legs*, 1–4–2–3, right II and left III missing, no spines and few hairs, pale with wide darker distal rings on femora and tibiae and a faint ring on metatarsi, most distinct on fourth leg; *palpi* as long as cephalothorax, terminal joint large, the parts best understood from the figure.

Holotype ♂ Dom. Rep.; San Jose de las Matas, 1,500 feet, June 1938, (Darlington)

Dipoena morosa belongs to the third group of Simon, represented in Europe by *Dipoena convexa* Blackwall.

Genus LATRODECTUS Walckenaer 1805

LATRODECTUS GEOMETRICUS Koch

Latrodectus geometricus C. L. Koch, 1841, 8, p. 117, pl. 284, fig. 684. "Ein Weibchen. Südamerika, Columbien."

♀ Haiti; Port-au-Prince, July, (Audant)

LATRODECTUS MACTANS (Fabr.)

Aranea mactans Fabricius, 1792, 2, p. 410, no. 11.

Common in all collections.

Genus THYMOELLA gen. nov.

Cephalothorax attenuate in male, not very high, no thoracic groove; anterior eye row carried forward on a tapering lobe, the row strongly recurved, eyes of posterior row procurved, lateral eyes touching, posterior median eyes almost touching; *clypeus* higher than quadrangle; *labium* wider than long; *sternum* as wide as long, convex, carried between posterior coxae in a broad lobe; *abdomen* globose; *legs*, 1–2–4–3, no spines, tarsi almost as long as metatarsi, comb of short curved bristles on fourth tarsus; *palpus* with a very long patella, tibia broad, little shorter than patella and extending over cymbium.

In the female, the eye area not carried forward in a lobe, *cephalothorax* strongly convex, with a faint thoracic groove; *eyes* anterior row not strongly recurved, posterior row almost straight, median eyes separated by a diameter; *abdomen* oval.

Holotype *Thymoella banksi* spec. nov.

The genus *Thymoella* differs from *Thymoites* Keyserling in that the male has a much more elongate cephalothorax, and the posterior median eyes are almost touching, and from the genus *Dipoena* in the elongate and much lower cephalothorax and the arrangement of eyes. In the figure of the palpus of *Thymoites crassipes* Keys., the genotype, the patella is greatly elongated, but it is impossible to trace the shape of the tibia.

THYMOELLA BANKSI spec. nov.

Figures 58, 59, 62, 64, 65, 66

Male. Length, 2.0 mm., ceph. 1.1. mm., abd. 1.1 mm.

Cephalothorax pale brown, eye area pale and a narrow median pale stripe, eyes carried forward and upward on a slender tapering horn best understood from the figure, a median row of stiff bristles from p.m.e. to near posterior margin, no thoracic groove; *eyes* relatively small, seen from above the anterior row strongly recurved, eyes about equidistant, a.m.e. separated by about two diameters, larger than a.l.e., posterior row procurved, p.m.e. smallest of the eight, almost touching, a strong curved bristle on outer side of p.m.e., directed backward, p.l.e. slightly larger than a.l.e., lateral eyes touching; a row of three small bristles posterior to lateral eyes; *quadrangle* of median eyes wider in front and higher than wide; *clypeus* very high and concave; *mandibles* vertical and rather small; *labium* wider than long; *maxillae* more than twice as long as labium, tips meeting; *sternum* pale, triangular, as broad as long, widest between the first coxae, convex, posterior coxae separated by a diameter and sternum continued between as a lobe; *abdomen* globose, pale, with a broad median dark stripe with irregular margins which do not reach either end, a short dark stripe on sides, venter pale with a dark ring about the spinnerets, entire abdomen with many short hairs; *legs*, 1–2–4–3, same color as cephalothorax, anterior pairs covered with rows of hairs, tarsi almost as long as metatarsi, comb of stiff bristles on fourth tarsus; *palpus* not as long as cephalothorax, patella more than half as long as femur, thickened, with two strong dorsal bristles, basal bristle longer and directed backward, tibia not as long as patella, very broad and more than half covering the cymbium, palpus shows little structure, with a very short embolus at the tip.

Female. Length, 2.1 mm., ceph. 0.9 mm., abd. 1.2 mm.

Cephalothorax brown, with no pale stripe as in the male, eye area not carried forward, strongly convex, sides rounded, thoracic groove short and shallow; *eyes* cover the width of the head, anterior row recurved, eyes subequal, a.m.e. separated by less than a diameter and from a.l.e. by a diameter and a half, posterior row almost straight, p.m.e. separated by a diameter and from p.l.e. by fully two diameters, lateral eyes touching; *quadrangle* of median eyes narrower in front and higher than wide; *clypeus* not as high as quadrangle and convex; *sternum* triangular, as wide as long, widest between first coxae, ending in a narrow lobe between posterior coxae; *abdomen* oval, covered with dull gray irregular spots, separated by pale lines, the median stripe found in the male is broken into spots, venter dull brown, spinnerets at tip, entire abdomen with many short hairs; *legs*, 1–2–4–3, pale brown, femora darker at the tips with rows of short hairs; *epigynum* very large for the size of the spider, area longer than wide, basal half convex, the two large spermatheca above the fold very large and prominent.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Allotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, June 1938, (Darlington)

The male and female of *Thymoella banksi* were found together, but they differ greatly in several characters. In the male, the cephalothorax is not high, and the anterior margin is drawn out in a lobe which carries the anterior median eyes, and the median eyes of the posterior row are almost touching. In the female, there is no anterior lobe and the two rows of eyes are closer together with the posterior median eyes largest and separated by fully one diameter. The abdominal markings are very distinct in the female but in the male, only the median row is distinct, the lateral marks being quite faint.

Subfamily CONOPISTHINAE

Genus Conopistha Karsch 1881

Conopistha caudata (Tacz.)

Ero caudata Taczanoswki, 1872, p. 63. "♂ ♀ French Guiana; Uassa."
Argyrodes caudatus Keyserling, 1884, 1, p. 198, pl. 9, fig. 119.

♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)
2 ♀ Dom. Rep.; Cordillera Central, rain forest north of Valle Nuevo, 6,000 feet, June 1938, (Darlington)

CONOPISTHA NEPHILAE (Tacz.)

Argyrodes nephilae Taczanowski, 1872, p. 114. "♂ ♀ Cayenne des Iles du Salut et de Saint Laurent de Maroni."

♂ ♀ Haiti; Dame-Marie, 1941, (Audant)
♂ ♀ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

CONOPISTHA OBTUSA (Cambridge)

Argyrodes obtusa O.P.-Cambridge, 1880, p. 338, pl. 30, fig. 17. "♂ Prof. Traill's Amazons collection."

♂ ♀ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

Genus SPINTHARUS Hentz 1850

SPINTHARUS FLAVIDUS Hentz

Spintharus flavidus Hentz, 1850, **6**, p. 284, pl. 10, fig. 8; reprint, p. 156, pl. 17, fig. 8. "♀ Alabama."

♀ Haiti; La Visite, 6,000–7,000 feet, 16–23 September 1934, (Darlington)
♀ Haiti; foot hills north-east of La Hotte, 4,000 feet, 3 October 1934, (Darlington)
3 ♀ Dom. Rep.; Cordillera Central, north of Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)
♂ Dom. Rep.; foot hills of Cordillera Central, north of Santiago, 2,000–5,000 feet, June 1938, (Darlington)
♀ Dom. Rep.; Cordillera Central, rain forest north of Valle Nuevo, 6,000 feet, August 1938, (Darlington)

Subfamily THERIDIINAE

Genus ANELOSIMUS Simon 1891

ANELOSIMUS FRATERNUS spec. nov.

Figures 55, 57

Male. Length, 2.5 mm., ceph. 1.1 mm., abd. 1.5 mm.

Cephalothorax pale brown, faintly shaded with a darker brown on sides and anterior to groove, almost two-thirds as wide as long, (5.5 : 9.0), sides evenly rounded, anterior margin narrowed, cephalothorax quite low, thoracic groove transverse; *eyes* cover anterior margin, seen from above, anterior row recurved, a.m.e. diurnal, convex, separated by less than a diameter, a.l.e. about three-quarters the diameter of a.m.e. and separated from them by a radius of a.m.e., posterior row straight, eyes equidistant, p.m.e. largest of the eight, separated by a diameter, p.l.e. touching a.l.e., slightly larger than a.l.e. and on a low tubercle; *quadrangle* higher than wide and slightly narrower in front; *clypeus* about as high as quadrangle, convex; *mandibles* pale, vertical, weak; *labium* wider than long, not fused to the sternum; *maxillae* pale, about twice as long as labium, inclined; *sternum* dark, triangular, widest between first coxae, almost as wide as long, fourth coxae separated by a diameter; *abdomen* oval, with a median dark stripe bordered on basal half by a narrow cream-colored stripe, sides pale brown, dorsum sparsely covered with long hairs, venter dark from fold to spinnerets; *legs*, 1–2–4–3, pale, with no dark rings or lines, I pair very long, femur with a prolateral row of long colorless hairs or bristles, tibia with median ventral row of bristles; *palpus* not as long as cephalothorax, tibia little longer than patella, anterior ventral margin with several long bristles that almost reach the tip of the palpal cavity, embolus starts about the middle on one side, follows the contour of the cavity and ends in a slender black point that rests against a lobe that extends outside the cavity. A prolateral view of the palpus shows the cymbium very much excavate near the tip and a small black curved piece below the end of the embolus.

Holotype ♂ Haiti; Ennery, 10 September 1934, (Darlington)

Anelosimus fraternus is separated from the other species in the genus by the slender embolus that has no branch near the tip. The large flask-shaped body in the middle of the palpus has a slender tip. In *A. studiosum* (Hentz), the tip of this piece is bulbous and the embolus is branched, while in *A. eximius* (Keys.), the embolus is coiled and the tip has an abrupt turn near the tip.

ANELOSIMUS STUDIOSUM (Hentz)

Theridium studiosum Hentz, 1850, p. 275, pl. 9, fig. 5; reprint, 1872, p. 145, pl. 16, fig. 5. "South Carolina; Alabama." [♀]

♀ Haiti Port-au-Prince, (Crew), Banks Coll.

One female, much broken and faded from age.

Genus CHRYSSO O.P.-Cambridge 1882

CHRYSSO ALBOMACULATUS

Chrysso albomaculata O.P.–Cambridge, 1882, p. 429, pl. 30, fig. 6. "♂ ♀ Amazon"

♀ Haiti; Dame-Marie, 1941, (Audant)

Genus EPISINUS Latreille 1809

EPISINUS GRATIOSUS Bryant

Episinus gratiosus Bryant, 1940, p. 313, fig. 65. "♀ Cuba; Oriente, Pico Turquino, 1,500 feet."

♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)

Genus THERIDION Walckenaer 1805

THERIDION FUESSLYI Simon

Figure 54

Theridion fuesslyi Simon, 1894, p. 522, fig. 3. "♀ ♂ Insula Sancti Vincentii"

Female. Length, 3.0 mm., ceph. 1.0 mm., abd. 2.0 mm. long, 2.1 mm. wide.

Cephalothorax a bright orange-yellow, with a dark brown triangle ending abruptly before the posterior margin, a narrow marginal dark stripe ending above the second coxae, cephalothorax almost as wide as long, cephalic portion high, no thoracic groove; *eyes* almost cover anterior margin, anterior row recurved, a.m.e. diurnal, separated by a radius, slightly larger than a.l.e., and separated from them by less than a radius, lateral eyes touching, subequal, posterior row slightly procurved, eyes equidistant, p.m.e. largest of the eight, separated by about a diameter; *quadrangle* almost square; *clypeus* dark, about as high as quadrangle, inclined slightly foreward; *mandibles* vertical, brown, weak; *labium* fused to sternum, wider than long; *maxillae* twice as long as labium, inclined; *sternum* yellow, convex, triangular, as wide as long; *abdomen* slightly wider than long, dorsum flat, pale, veined with dark brown, with a pale median notched stripe that does not reach the base, venter infuscate; *legs*, 1–4–2–3, no true spines but rows of hairs and long colorless bristles, pale, femora with a dark median ventral stripe and a dark dorsal stripe, not connected with the ventral stripe, a dark ring at the tip, I tibia with a wide dark distal band; *epigynum*, area convex, rather small for the size of the spider, a narrow ellipical opening at the fold with parallel chitinized margins, and at each end a small circular opening, areas above smooth and strongly convex, still nearer the pedicel are dark sacs beneath the surface.

♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)

Simon had both sexes, but unfortunately figured the male palpus only. At the end of the description, he compared the species with *Theridion differens* Emerton and *Theridion antoni* Keyserling. Both have the pale herring-bone figure on the dorsum and a median dark stripe on the cephalothorax that ends abruptly before the thoracic groove. These markings are constant.

Genus THERIDULA Emerton 1882

THERIDULA OPULENTA (Walckenaer)

Theridion opulenta Walckenaer, 1842, **2**, p. 322. "Georgia" [♀]

♂ ♀ Haiti; Diquini, November 1912, (Mann)
♀ Haiti; swamp north of Dessalines, 11 August 1934, (Darlington)
♀ Haiti; Ennery, 10 September 1934, (Darlington)
♀ Haiti; hills south of Port-au-Prince, 2 October 1934, (Darlington)

♀ Haiti; foot hills north-east of La Hotte, 4,000 feet, 3 October 1934, (Darlington)
♀ Dom. Rep.; Puerto Plata, 30 August 1938, (Darlington)

Subfamily NESTICINAE

Genus NESTICUS Thorell 1869–1870

NESTICUS MACULATUS spec. nov.

Figures 60, 63

Male. Length, 2.6 mm., ceph. 1.1 mm., abd. 1.6 mm.

Cephalothorax pale, except for a gray spot before the thoracic groove, cephalic portion slightly raised, thoracic portion flat; *eyes* cover two-thirds of the anterior margin, anterior row straight by the diameters, a.m.e. very small, separated by less than a diameter and from a.l.e. by only a line, posterior row slightly procurved, eyes subequal with a.l.e., p.m.e. separated by slightly more than a diameter and almost touching p.l.e., lateral eyes touching, so that a.l.e. and eyes of posterior row form a triad; *quadrangle* of median eyes narrower in front and not quite as high as width behind; *clypeus* as high as quadrangle; *mandibles* pale, vertical, and weak, fang groove slightly oblique; *labium* pale, wider than long, tip rebordered; *maxillae* pale, more than twice as long as labium, parallel; *sternum* pale, convex, as wide as long, widest between the second coxae, continued between fourth coxae which are separated by more than a diameter; *abdomen* cylindrical, about half as wide as long, not narrowed at tip and truncate above the spinnerets, pale, with a median dark spot about the middle of the dorsum and three pairs of small lateral dark spots, venter pale; *legs*, 1–2–4–3, colorless, with few bristles, I pair very long, fourth tarsus with a comb of 9 curved bristles and a dorsal and ventral rows of long bristles; *palpus* longer than cephalothorax, pale, patella little longer than diameter, with a long dorsal trichobothria near tip, tibia with a dorsal wing-like projection so that width almost equals the length of the joint, with two dorsal trichobothria, paracymbium with chitinized margins, very long and projecting at right angles from the cymbium, tip recurved and a long chitinized point projecting towards the cymbium, palpal organ large and projecting from the cavity, embolus arises from near the base, continuing as a narrow black line across the base and ending as a free point just below the tip, at the tip of the organ a large recurved colorless hook, extends from the plane above a long straight piece with a dark point below the recurved hook.

Female. Length, 3.0 mm., ceph. 1.1 mm., abd. 2.1 mm.

Cephalothorax and *eyes* the same as the male; *abdomen* cylindrical, pale, with the same seven dark spots as in the male, and with irregular cream spots at the posterior angles, abdomen very high above and carried beyond the spinnerets; *legs*, 1-2-4-3, pale with dark bands at base and tip of tibiae, no spines but many long hairs, anterior pairs very long, a comb of colorless bristles on fourth tarsus; *epigynum*, area wider than long, very faintly marked, two widely separated dark areas beneath the surface and openings probably clear round spaces separated by a diameter above the fold.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Viega, south of Constanza, 6,000 feet, August 1938, (Darlington)

Allotype ♀ Dom. Rep.; Cordillera Central, rain forest, south of Valle Nuevo, 6,000 feet+, August 1938, (Darlington)

Paratype ♀ Dom. Rep.; Cordillera Central, rain forest, south of Valle Nuevo, 6,000 feet+, August 1938, (Darlington)

The male and female were found in the same general region and have the same abdominal markings. The female paratype has no dark spots on the abdomen but agrees in other particulars with the type specimens. *Nesticus maculatus* differs from the genotype, *cellulanus*, and most of the others species in the genus, in the widely separated posterior median eyes and the cylindrical abdomen, which is carried beyond the spinnerets and is squarely truncate at the tip. *Nesticus eremita* Simon found in France, Switzerland and Greece has the p.m.e. separated by more than a diameter, has a small median dark spot on the cephalothorax, and pairs of small dark spots on the sides of the abdomen, but the figures of the palpus and epigynum are totally unlike the Hispaniola species.

NESTICUS PALLIDUS Emerton

Nesticus pallidus Emerton, 1875, p. 278, pl. 1, figs. 22–27. "♂ ♀ Virginia; Fountain Cave."

♀ Haiti; Cap Haitien, January 1913, (Mann)
♀ Haiti; Kenskoff, 4,500–5,500 feet, 2 September 1934, (Darlington)
♂ ♀ Haiti; Ennery, 10 September 1934, (Darlington)

♀ Dom. Rep.; Mt. Diego de Ocampo, 3,000–4,000 feet, July 1938, (Darlington)

♀ Dom. Rep.; Puerto Plata, 30 August 1938, (Darlington)

Family LINYPHIIDAE

Subfamily LINYPHINAE

Genus FRONTINELLA F.O.P.-Cambridge 1902

FRONTINELLA BELLA spec. nov.

Figure 67

Female. Length, 3.0 mm., ceph. 1.0 mm., abd. 2.1 mm.

Cephalothorax brown, head moderately high, greatest width little more than half the length, sides only slightly rounded, thoracic groove very short; *eyes,* anterior row recurved, eyes subequal, a.m.e. separated by a radius and from a.l.e. by more than a diameter, posterior row straight, lateral eyes touching and subequal, p.m.e. largest of the eight, heavily ringed with black and slightly raised, separated by a diameter and a half, and from p.l.e. by a diameter; *quadrangle* narrower in front and higher than wide; *clypeus,* a distinct groove below anterior row of eyes, convex, and about as high as quadrangle; *mandibles* brown, vertical, upper margin of fang groove with three or four sharp teeth, lower margin with four small teeth; *labium* dark, wider than long; *sternum* black, convex, triangular, tip carried between posterior coxae; *abdomen* oval, elevated in a blunt tubercle above the spinnerets, dorsum gray with a faint darker gray basal spear-mark and fine transverse dark lines at tip about the tubercle, a narrow yellow stripe on sides separates dorsum from the venter, venter black; *legs* somewhat broken, 1–2–4–3, pale with a narrow dark ring at tips of anterior tibiae and metatarsi, very few spines; *epigynum* rather large for the size of the spider, area wider than long, a large depressed area each side of a narrow septum with small oval openings near the lower margin, in the anterior portion a globular sac beneath the surface.

Holotype ♀ Dom. Rep.; Cordillera Central, Constanza, 3,000–4,000 feet, August 1938, (Darlington)

Frontinella bella does not agree in all characters with the original description of the genus by Cambridge. The eyes of the posterior row are not subequal, but Dr. Blauvelt in the recent revision of the

American species of the genus, places *Linyphia communis* Hentz and *Linyphia coccinea* Hentz in this genus, both of which have the posterior median eyes larger than the posterior laterals. Both of these species have the epigynum of the same general plan.

FRONTINELLA COCCINEA (Hentz)

Linyphia coccinea Hentz, 1850, p. 30, pl. 4, fig. 8; reprint, 1875, p. 132, p. 15, fig. 8, pl. 18, fig. 12. "North Carolina"
Frontinella coccinea Blauvelt, 1937, p. 149, pl. 14, figs. 96–100.

♀ Haiti; Kenskoff, 4,500–5,000 feet, 2 September 1934, (Darlington)
♂ ♀ Haiti; Kenskoff, 4,300 feet, 1 May 1935, (Roys)

FRONTINELLA COMMUNIS (Hentz)

Linyphia communis Hentz, 1850, p. 28, pl. 4, fig. 4; reprint, p. 132, pl. 15, fig. 4, pl. 18, fig. 104, pl. 19, fig. 118. "♀ United States, though somewhat rare in the North."
Frontinella communis Blauvelt, 1937, p. 145, pl. 13, figs. 90–94, pl. 14, fig. 95.

♂ Haiti; La Visite, 6,000–7,000 feet, 16–23 September 1934, (Darlington)

Subfamily LOPHOCARENINAE

Genus CERATICELUS Simon 1884

CERATICELUS SOLITARIUS spec. nov.

Figure 68

Female. Length, 1.6 mm.

Cephalothorax yellowish-orange, black between the eyes, shining, sides evenly rounded, moderately convex; *eyes* cover the anterior margin, anterior row recurved, a.m.e. smallest of the eight, separated by a radius, and from a.l.e. by a diameter and a half, posterior row straight, eyes equidistant and subequal, lateral eyes touching: *quadrangle* narrower in front and higher than wide; *clypeus* convex, and as high as the quadrangle; *sternum* yellowish-brown, wider than long, convex, posterior coxae separated by almost two diameters; *abdomen* oval, paler than cephalothorax, darker above the spinnerets, covered with short hairs, each from a chintinized pit, the four muscle spots distinct, no dorsal scutum, venter paler, inframammillary scutum faint; *epigynum,* area wider than long, very similar to *Ceraticelus emertoni* (Cambridge).

Holotype ♀ Dom. Rep.; Cordillera Central, Valle Nuevo, southeast of Constanza, 7,000 feet, August 1938, (Darlington)

Subfamily ERIGONINAE

Genus CERATINOPSIS Emerton 1882

CERATINOPSIS ANGLICANA (Hentz)

Theridion anglicanum Hentz, 1850, p. 275, pl. 9, fig. 6; reprint, p. 146, pl. 16, fig. 6. "♀ Alabama, in June."

♀ Haiti; La Visite, 6,000–7,000 feet, 16–23 September 1934, (Darlington)

♂ Haiti; Furcy, Mt. Cabaio, 7,000 feet, 26 March 1940, (Folk)

Genus EPERIGONE Crosby and Bishop 1928

EPERIGONE ANTILLANA spec. nov.

Figures 69, 72, 74

Male. Length, 2.5 mm., ceph. 0.9 mm., abd. 1.2 mm.

Cephalothorax pale brown, head rather high, about three-quarters as wide as long, (5.0 : 6.5), thoracic groove distinct; *eyes,* anterior row recurved, a.m.e. smallest of the eight, separated by less than a radius, and from a.l.e. by a radius, posterior row straight, eyes about equidistant and subequal, p.m.e. separated by almost a diameter, lateral eyes touching; *quadrangle* narrower in front and higher than wide; *clypeus* convex and higher than quadrangle; *mandibles* brown, vertical, slightly divergent, outer margin near base with a row of 5–6 graduated teeth, inner margin with a long tooth above fang groove that projects slightly, fang groove long and oblique, upper margin with five teeth, lower margin with three teeth, fang long and curved; *labium* brown, fused to sternum, wider than long; *maxillae* more than twice as long as labium, slightly inclined, very broad; *sternum* brown, convex, triangular, as wide as long, emarginate opposite coxae, extending between posterior coxae in a bilobed point, fourth coxae at distal end with a row of nodules; *abdomen* oval, a smoky-brown, with a faint darker median stripe and inconspicuous dark cross bars on posterior half, many short hairs; *legs,* 1–2–4–3, pale brown, many hairs, no spines but a bristle at the tip of patellae; *palpus* as long as cephalothorax, patella plus tibia not as long as femur, left femur with a basal, ventral row of four small nodules, each bearing a seta, right femur with larger nodules, patella with a very small ventral spur at distal end, tibia little longer than patella, very broad at distal end with a large pointed dorsal lobe that rests on the cymbium, paracymbium narrow, straight with tip bent, palpal organ with three cusps near tip and one about the middle.

Female. Length, 2.2 mm., ceph. 1.0 mm., abd. 1.3 mm.

Cephalothorax, eyes and *clypeus* same as in male; *mandibles* brown, vertical, not divergent, no teeth on either margin, fang groove oblique, upper margin with five teeth, the three basal teeth large, lower margin with three teeth; *sternum* brown, convex, wider than long, faintly produced between coxae, and a long bifid lobe between the posterior coxae, not as deeply bifid as in the male; *abdomen* grayish-brown, paler at the base, with no indications of the markings found in the male, many long hairs; *legs,* 1–2–4–3, pale brown, no spines but many hairs, patellae with bristle at the tips; *epigynum* very dark at the tip, area longer than wide, with two depressed areas close together at the anterior end.

Holotype ♂ Haiti; Miragoane, 2 November 1934, (Darlington)

Allotype ♀ Haiti; Miragoane, 2 November 1934, (Darlington)

Paratype ♂ Haiti; Miragoane, 2 November 1934, (Darlington)

Paratypes ♂ ♀ Haiti; La Visite, 6,000-7,000 feet, 16-22 September 1934, (Darlington)

Paratype ♂ Dom. Rep.; Cordillera Central, Valle Nuevo, southeast of Constanza, 7,000 feet+, August 1938, (Darlington)

In 1897 Simon described two species of *Erigone* from St. Vincent, and compared them to *Erigone dentimandibulata* Keys. from Colombia and Peru. All three species have a retrolateral row of teeth on the mandible of the male. *Erigone poeyi* Simon and *Erigone dentimandibulata* Keys. have the male palpus greatly elongate, and the ventral spur on the patella, so characteristic of the true *Erigone,* is reduced to a short cusp. Simon states that he has several related species from the mountains of Venezuela. As no figures or description of the palpus of the two St. Vincent species is given, it is impossible to identify them accurately and perhaps the Hispaniola species is *E. poeyi* Simon, or even *E. dentimandibulata* Keys. from Colombia. Many species of *Eperigone* are common in the autumn flights and have a wide distribution.

Eperigone antillana is probably related to *Oreonetides portoricensis* Petrunkevitch, described from a female. Both species have the sternum bifid between the posterior coxae and the epigyna are tripartite. The genus *Oreonetides* belongs to the *Linyphiinae* and the species are confined to northern Europe. *Eperigone antillana* belongs to the *Erigoninae.*

Genus GRAMMONOTA Emerton 1882

GRAMMONOTA CALCARATA spec. nov.

Figures 70, 78

Male. Length, 2.0 mm., ceph. 0.9 mm., abd. 1.3 mm.

Cephalothorax orange-brown, smooth, a few long bristles posterior to the eyes, cephalic portion only slightly raised, sides rounded, thoracic groove distinct; *eyes,* each eye surrounded by black, anterior row straight, eyes subequal, a.m.e. separated by a radius and from p.l.e. by a diameter, posterior row slightly procurved, eyes subequal and equidistant, p.m.e. separated by more than a diameter, lateral eyes touching; *quadrangle* narrower in front and higher than wide; *clypeus* vertical, higher than quadrangle; *mandibles* brown, vertical, upper margin of fang groove with three teeth; *labium* brown, wider than long; *sternum* pale, convex, heart-shaped, wider than long, (3.5 : 3.0), posterior coxae separated by a diameter with the lobe of the sternum between; *abdomen* oval, pale, shining, with a broken median dark line and on sides two pairs of widely separated dark spots, a basal and a distal pair, venter pale, spinnerets at tip; *legs,* pale brown, long and slender, no spines and few hairs, a dorsal trichobothria on middle of fourth tibia; *palpus* longer than cephalothorax, patella slightly longer than wide, tibia much widened at distal end with a long slender curved apophysis that touches cymbium, paracymbium slender, sides parallel and distal third bent, embolus a slender graduated ribbon-like piece which crosses the middle of the organ, continues in a loop that extends beyond the cymbium, narrows abruptly and then turns downward.

Female. Length, 2.5 mm., ceph. 1.0 mm., abd. 1.6 mm.

Similar to the male, but the median dark line and the four dark spots on the abdomen are much larger; *epigynum,* area longer than wide.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Allotype ♀ Dom. Rep.; Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Paratypes ♂ ♀ Dom. Rep.; Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Paratype ♂ Dom. Rep.; Cordillera Central, Constanza to Jarabacoa, 2,000–4,000 feet, August 1938, (Darlington)

Paratype ♂ Dom. Rep.; Cordillera Central, rain forest, north of Valle Nuevo, 6,000 feet, August 1938, (Darlington)

The male from Constanza is much darker than the others, but the tibial apophysis and the embolus is the same as in the holotype.

Genus LOMAITA gen. nov.

Cephalothorax almost as wide as long, cephalic portion very high and rounded; *eyes*, anterior row recurved, a.m.e. smallest of the eight, separated by about a diameter, lateral eyes subequal and touching, posterior row procurved, p.m.e. largest of the eight, separated by about two diameters; *clypeus* convex, higher than quadrangle; *mandibles* vertical, no boss, fang groove oblique, upper margin with two teeth, lower margin with granules; *labium* wider than long, tip rebordered; *sternum* almost as wide as long, carried between the posterior coxae in a broad lobe; *abdomen* cylindrical, truncate at base and at tip; spinnerets not surrounded by a chitinous ring; *legs*, 1–2–4–3, (?), moderately long, slender with few spines; *palpus*, tibia and patella both short, embolus extending beyond the cymbium as in *Achaea trapezoidalis* (Tacz.). Female unknown.

Genotype *Lomaita darlingtoni* spec. nov.

The position of the genus *Lomaita* is very uncertain. The clypeus is very high even for an Erigonid, the abdomen is cylindrical, and truncate at both base and tip. The palpus is rather large for the size of the spider and the embolus is very long. The palpus suggests that of *Sphecozone nigra* O.P.-Cambridge, 1882, from the Amazons, but all members of that genus have a long chitinous pedicel, so that the cephalothorax and abdomen are widely separated. The mandibles have no stridulating ridges, so it can not be placed in the *Linyphiinae* according to the definition of that subfamily as limited by Petrunkevitch. As the second pair of legs are missing, it is not possible to tell if they are modified and so the genus could be placed in the *Argiopidae*. There are no trichobothria on the fourth tibiae.

LOMAITA DARLINGTONI spec. nov.

Figures 75, 76, 77

Male. Length, 3.0 mm., ceph. 1.2 mm. long, 1.0 mm. wide, abd. 1.7 mm. long.

Cephalothorax dull yellow, smooth, vaguely shaded with black about the sides and in the middle area, almost as wide as long, cephalic portion very high, thoracic groove short but distinct, anterior margin rounded and about half the greatest width; *eyes* cover two-thirds the width of the head, anterior row slightly recurved, a.m.e. diurnal, on a transverse black spot, smallest of the eight, separated by about a diameter and from a.l.e. by fully two diameters of a.m.e., lateral eyes subequal and touching, posterior row slightly procurved, p.m.e. largest of the eight, each on a raised black spot, so they appear much larger than the actual diameter, separated by about two diameters and from p.l.e. by a diameter; *quadrangle* much narrower in front and as high as wide behind; *clypeus* slightly protruding, convex, and higher than the quadrangle and very conspicuous; *mandibles* yellowish, vertical, basal half swollen, no boss, slightly divergent, fang groove oblique, upper margin with a blunt tooth near the base of the fang and a larger sharper tooth near the median edge, lower margin with a few granules opposite the sharp tooth, fang as long as the groove; *labium* much wider than long, sides parallel, tip rebordered, not fused to the sternum; *maxillae* parallel, three or four times as long as labium; *sternum* orange-brown, triangular, almost as wide as long, slightly excavate opposite the coxae, and carried between posterior coxae in a broad lobe; *pedicel* short; *abdomen* pale, with a few dark marks on the sides, cylindrical, more than twice as long as wide, truncate at base and at the tip, venter pale, with a thin scutum from fold to half way to the spinnerets, followed by a slightly shorter scutum that reaches the spinnerets; *legs* much broken, 1–2–4–3, (?), same color as cephalothorax, long and slender, anterior tarsi not enlarged, a very few slender spines and a few hairs on first tibia, second tibia missing, no ventral spines on posterior pairs; *palpus* fully as long as cephalothorax, terminal joint very large, femur slender, patella and tibia subequal, about as long as diameter, paracymbium small and chitinized, cymbium covers about half of the palpus, palpal organ complicated, embolus starts near the base and continues as a very long free hair-like thread outside the palpus; most conspicuous part in the palpus, is a membrane which also starts at the base and ends in a flattened disc at the tip, the outer margin of the membrane darker and ends beyond the disc, on the prolateral side, this membrane is folded over and beneath the edge is a very long slightly curved dark spine that extends the length of the palpus and ends beyond the disc.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Viega, south of Constanza, 6,000 feet, August 1938, (Darlington)

Family ULOBORIDAE

Genus MIAGRAMMOPES O.P.-Cambridge 1870

MIAGRAMMOPES LATENS Bryant

Miagrammopes latens Bryant, 1936, p. 326, fig. 4. "♂ Cuba; Sierra del Cobre, Loma del Gato, 2,600–3,325 feet."

The holotype has lost the spines on the first tibia and metatarsus. A perfect male from Loma Rucilla Mountains, at an elevation of 5,000–8,000 feet, has the spines complete. A prolateral row of rather short black spines of about equal length that are at right angles to the joint and a retrolateral row of graduated black spines, longer at the base than at the distal end and about the same size as those of the prolateral row. The first metatarsus is slightly curved at the base with a short prolateral row of graduated black spines and a parallel retrolateral row of three short spines. The ventral row of short spines on the fourth metatarsus and tarsus found in the female is missing.

The female has a short ventral brush of long colorless hairs on the first tibia on the distal quarter. This is found on the half grown specimens as well as on the adult. The ventral row of short black cusps on the fourth metatarsus and tarsus is very conspicuous.

♂ ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

♀ Dom. Rep.; Cordillera Central, rain forest north of Valle Nuevo, 6,000+ feet, August 1938, (Darlington)

Genus ULOBORUS Latreille 1806

ULOBORUS AMERICANA Walck.

Uloborus americana Walckenaer, 1842, p. 229.

♀ Dom. Rep.; Sanchez, July 1938, (Darlington)

ULOBORUS GENICULATUS (Olivier)

Aranea geniculata Olivier, 1791, p. 214, no. 57.

♀ Dom. Rep.; Puerto Plata, July 1941, (Hurst)

Family DEINOPIDAE

Genus DEINOPIS MacLeay 1839

DEINOPIS LAMIA MacLeay

Deinopis lamia MacLeay, 1839, p. 9.

♂ pullus Haiti; Diquini, November 1912, (Mann)
♂ Dom. Rep.; Puerto Plata, August 1941, (Hurst)

Family ARGIOPIDAE

Subfamily TETRAGNATHINAE

Genus LEUCAUGE White 1841

LEUCAUGE HORTORUM (Hentz)

Epeira hortorum Hentz, 1847, p. 477, pl. 31, fig. 19; reprint, p. 118, pl. 13, fig. 19. "All the United States."

♂ ♀ Haiti; Port-au-Prince

Subfamily THERIDIOSOMATINAE

Genus OGULNIUS O.P.-Cambridge 1882

OGULNIUS LATUS spec. nov.

Figures 71, 73

Female. Length, 1.0 mm., ceph. 0.5 mm., abd. 0.7 mm. long, 0.9 mm. wide.

Cephalothorax mahogany-brown, cephalic portion very high, thoracic portion concave and falling abruptly to the posterior margin, impossible to see if the thoracic groove is present; *eyes* on a raised tubercle, anterior row recurved, a.m.e. separated by a diameter, a.l.e. smaller than a.m.e., posterior row procurved, p.m.e. largest of the eight, separated by almost a diameter and a half, and from p.l.e. by less than a diameter of p.m.e., lateral eyes touching, and p.l.e. larger than a.l.e.; *quadrangle* narrower in front and higher than wide; *clypeus* not as high as quadrangle, a deep groove below anterior eye row; *mandibles* brown, small, vertical; *labium* pale, wider than long; *maxillae* a little longer than labium, inclined; *sternum* brown, slightly convex, as wide as long, anterior margin very broad, posterior margin fully two-thirds as wide as the anterior, so that the fourth coxae are separated by more than two diameters; *abdomen* dark, with no markings, wider than long, dorsum flat, anterior portion extending over cephalothorax so that all of the thoracic portion is covered, sides almost parallel and posterior angles developed into small tubercles, anterior angles not as distinct, height above spinnerets almost as much as the extreme width, venter mottled, spinnerets closely grouped; *legs* short and stout, differing little in length, pale, anterior pairs darker than the posterior, all joints with colorless hairs, no spines, a long colorless bristle at the tip of patellae and a dorsal median bristle on tibiae, these may be trichobothriae; *epigynum* very close to pedicel, a dark chitinous lobe which projects from the plane of the abdomen and shows no structure.

Holotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla, 5,000–8,000 feet, June 1938, (Darlington)

Ogulnius latus is about the same size as the genotype, *Ogulnius obtectus* O.P.-Cambridge from the Amazon, but the latter has a globose abdomen which extends far over the cephalothorax, and the cephalothorax is described as yellow with elongate dark marks about the margin. *Ogulnius latus* has a high abdomen which also extends over the cephalothorax, but the dorsum is flat, and seen from above, is almost rectangular. The abdomen is not unlike the figure of *Epeirotypus gloriae* Petrunkevitch from Puerto Rico, but this species has a cephalic turret posterior to the eyes and the sternum is not broadly truncate between the coxae.

Family MIMETIDAE

Genus MIMETUS Hentz 1832

MIMETUS HISPANIOLAE spec. nov.

Figures 79, 80

Male. Length, 3.7 mm., ceph. 1.6 mm., abd. 2.1 mm. long, 1.6 mm. wide.

Cephalothorax pale, with a dark triangle from the eye area to the thoracic groove, with converging rows of long bristles on the outer margins of the dark area, thoracic groove long and deep; *eyes* cover the anterior margin, anterior row recurved, eyes equidistant, a.m.e. diurnal, each on a low tubercle, projecting slightly forward, separated by fully a diameter, slightly larger than a.l.e., posterior row procurved so that the lateral eyes are touching on a common tubercle, p.m.e. larger than a.m.e., rather flat and angular, separated by a radius and from p.l.e. by more than a diameter; *quadrangle* wider in front and higher than wide; *clypeus* less than a diameter of a.m.e., retreating; *mandibles* dark, vertical, long and narrow, fused at the base, fang groove very short, upper margin with three sharp teeth; *labium* longer than wide, tip pointed; *maxillae* narrow, longer than labium and tips almost touching; *sternum* triangular, dark about the margins, not continued between the posterior coxae; *abdomen* injured, triangular, about as wide as long, with lateral basal humps, posterior half with a dark folium, many long colorless hairs; *legs*, 1–2–4–3, anterior pairs very long, pale with dark broken rings and dark spots, in addition to the alternate long and short spines on the anterior tibiae and metatarsi, a dorsal row of very long dark spines, first femur with a retrolateral row of very short curved spines on the basal third and a corresponding prolateral row of smaller spines on the second femur, these are called "thorns" by Dr. Petrunkevitch; *palpus* as long as cephalothorax, femur pale, long and slender, tibia little longer than patella, patella with one very long black dorsal spine, cymbium with a rounded lateral lobe near the tip, from which starts a thickened carina that continues to the base of the cymbium, palpal organ complicated with a thin membraneous lobe projecting from the center and a very short embolus.

Holotype ♂ Dom. Rep.; Cordillera Central, rain forest near Valle Nuevo, 6,000 feet+, August 1938, (Darlington)

The generic position of this species is uncertain. The palpi are very unlike the genotype or other species in the genus, and the cymbium has a single rounded lobe. The small curved spines between the long spines on the anterior tibiae and metatarsi have been broken, so that it is impossible to count the number. The p.m.e. are larger than the a.m.e. and are closer together than in most species. An immature female apparently of this species was found by Dr. Darlington at Loma Rucilla Mountains in the Central Cordillera, between 5,000 and 8,000 feet, in June 1938.

MIMETUS INTERFECTOR Hentz

Mimetus interfector Hentz, 1850, p. 32, pl. 4, figs. 12, 13; reprint, 1872, p. 138, pl. 15, figs. 12, 13. "♂ ♀ Alabama."

♀ Dom. Rep.; Puerto Plata, July 1941, (Hurst)

Family CTENIDAE

Subfamily CTENINAE

Genus CTENUS Walckenaer 1805

CTENUS AVIDUS spec. nov.

Figure 89

Female. Length, 13.0 mm., ceph. 7.0 mm., abd. 5.5 mm.

Cephalothorax mahogany-brown, moderately high, anterior margin truncate, more than half the greatest width, covered with short white hairs, thoracic groove very near the posterior margin; *eyes*, a.m.e. separated by less than a diameter, p.m.e. and a.l.e. form a slightly procurved line, with the eyes equidistant, p.m.e. largest of the eight, separated by about a diameter, a.l.e. smallest of the eight, oval, p.l.e. larger than a.m.e., strongly convex, slightly raised and directed backward, separated from a.l.e. by a diameter of p.l.e.; *quadrangle* narrower in front and wider behind than high; *clypeus* not as high as diameter of a.m.e.; *mandibles* dark brown, geniculate, with many long hairs and bristles, boss large, fang groove oblique, upper margin with three teeth, middle tooth largest, lower margin with four graduated teeth; *labium* brown, longer than broad; *maxillae* twice as long as labium; *sternum* pale, convex, three-quarters as wide as long, posterior coxae almost touching; *abdomen* much shrunken, so that design if any is impossible to trace; *legs* much broken, brown, with a heavy scopula on anterior metatarsi and tarsi, and a faint scopula on the distal half of anterior tibiae, spines, I tibia, ventral, 2–2–2–2–2, distal pair very short, lateral, 2, near distal end, metatarsus, ventral, 2–2–2, basal and median pairs very long, III and IV tibiae with a dorsal, basal spine; the spider has oviposited, *epigynum* large, area about as long as wide, middle area strongly convex, and covered with short hairs, two pairs of openings, widely separated, near fold and on each side strongly chitinized divergent areas.

Holotype ♀ Haiti; Petionville, November 1912, (Mann)

In 1910, Strand described *Ctenus haitiensis* ♀, from Haiti. This species is 13.0 mm. long with five pairs of ventral spines on the first tibia. The epigynum is described as small and indefinite, more than twice as wide as long. It is possible that the lateral spines could be described as ventral, but *Ctenus avidus* has the epigynum longer than wide and all parts are strongly chitinized.

CTENUS DARLINGTONI spec. nov.

Figure 86

Female. Length, 14.5 mm., ceph. 8.0 mm. long, 6.0 mm. wide, abd. 7.0 mm. long, 4.0 mm. wide.

Cephalothorax reddish-brown, median pale stripe very indistinct, anterior margin very little narrowed, cephalic portion high, thoracic groove long and deep and very near the posterior margin; *eyes* cover the middle half of the anterior margin, a.m.e. separated by more than a diameter, a.l.e. smallest of the eight and with p.m.e. form a slightly procurved line, posterior row recurved, p.m.e. separated by a diameter, a.l.e. nearer p.l.e. than to p.m.e.; *quadrangle* very little narrower in front than behind, and higher than wide; *clypeus* about as high as a diameter and a half of a.m.e.; *mandibles* reddish-brown, geniculate, no boss, fang groove slightly oblique, upper margin with three contiguous teeth, middle tooth largest, lower margin with five teeth, fang stout; *labium* brown, longer than wide, lateral margins near base notched; *maxillae* twice as long as labium, outer margins slightly emarginate; *sternum* brown, almost as wide as long, (8.0 : 9.0); *abdomen* some what shrunken as spider has oviposited, light brown, covered with white hairs, a wide median pale stripe from base to spinnerets with parallel dark stripes at base and on posterior half four pairs of widely separated dark spots, venter paler; *legs*, 4–1–2–3, fourth left missing, brown, no dark bands, scopula on tarsi and metatarsi much heavier on anterior pairs, spines, no ventral spines on femora, no dorsal spines on anterior tibiae, I pair, patella, 0, tibia, ventral, 2–2–2–2, heavy with incurved tips, all from a raised base, 1 pair of lateral spines near tip, no dorsal, metatarsus, ventral, 2–2–2, long and heavy, II pair same as I pair, posterior pairs with many heavy spines; *epigynum* red-brown, area fully twice as wide as long and covering about middle half of the width of the abdomen, of the characteristic type, a convex lobe with narrow darkened areas each side.

Holotype ♀ Haiti; La Hotte, 5,000–7,000 feet, 16–17 October 1934, (Darlington)

Ctenus darlingtoni is a much heavier spider than the other species seen from Hispaniola. The ventral spines on the tibiae are long and heavy, all from a raised base with the tips curved inward. It has but one pair of lateral spines on the anterior tibiae. The epigynum is unusually broad.

CTENUS HIEMALIS spec. nov.

Figure 81

Female. Length, 15.0 mm., ceph. 6.5 mm. long, 4.6 mm. wide, abd. 8.6 mm. long, 5.5 mm. wide.

Cephalothorax reddish-brown, median area paler but no distinct stripe, moderately high, anterior margin little narrowed, thoracic groove long and deep; *eyes* cover middle of anterior margin, a.m.e. about one-half the diameter of p.m.e., separated by a diameter, a.l.e. smallest of the eight, and with p.m.e. form a procurved line, posterior row recurved, p.m.e. largest of the eight, separated by less than a diameter, p.l.e. on a tubercle directed backward and separated from p.l.e. by a diameter and a half of p.m.e., a.l.e. as near to p.m.e. as to p.l.e.; *quadrangle* narrowed in front and as high as wide; *clypeus* below a.m.e. about as high as diameter of a.m.e.; *mandibles* reddish-brown, with many hairs, boss small, fang groove oblique, upper margin with three teeth, lower margin with four teeth, fang heavy; *labium* brown, longer than wide; *maxillae* twice as long as labium, outer margins parallel; *sternum* brown, convex, almost as wide as long, (6.0 : 7.0); *abdomen* brownish, a wide pale median stripe from base to spinnerets, with three pairs of dark spots just outside the median stripe on posterior half, venter paler; legs, 4–1–2–3, long and slender, very thin scopula on anterior tarsi and metatarsi, no ventral spines on femora, spines, I pair, tibia, ventral, 2–2–2–2, distal pair very small, 1 pair of lateral spines near the tip, no dorsal spines, metatarsus, ventral, 2–2–2, II pair same as I pair; *epigynum*, area as wide as long, a median septum narrow at the anterior end and widening to the greatest width at the posterior end, with round chitinized openings on the outer margins, the area each side of the septum is pale and convex.

Holotype ♀ Haiti; Diquini, November 1912, (Mann)

CTENUS INSULANUS spec. nov.

Figure 88

Male. Length, 9.0 mm., ceph. 4.8 mm. long, 4.0 mm. wide, abd. 4.8 mm. long.

Cephalothorax brown, the dark radial striae show faintly, lateral margins in life probably covered with white hairs as a few remain, anterior margin narrowed to less than half the greatest width, moderately convex, thoracic groove long, quite near to the posterior margin; *eyes* do not cover anterior margin, both rows strongly recurved, a.m.e. small, separated by a diameter, subequal to a.l.e., a.l.e. form a straight line with p.m.e., eyes of posterior row subequal, p.m.e. large, more than twice the diameter of a.m.e., separated by a little more than a radius and from p.l.e. by a diameter, many white hairs about the eyes; *quadrangle* narrower in front, and wider than high; *clypeus* almost wanting below a.m.e.; *mandibles* brown, with many dark bristles and long white hairs, vertical, fang groove oblique, upper margin with three contiguous teeth and with a thick scopula of long hairs to the base of the fang, lower margin with five graduated teeth, last tooth very small; *labium* longer than wide, basal third of lateral margins notched; *maxillae* more than twice as long as labium, sides parallel, outer margins only slightly emarginate; *sternum* pale, not quite as wide as long, convex, with many dark hairs, fourth coxae almost touching; *abdomen* light brown, with a pattern of five pairs of dark spots apparently formed by patches of hairs, many of which have been rubbed off, oval, venter pale with many long dark hairs; *legs*, III right missing, 4–1–2–3, brown, long and slender, spines, tibiae with dorsal spines, I pair, patella, prolateral, 1, tibia, ventral, 2–2–2–2–2, distal pair small, others long and strong, lateral, 2–2, metatarsus, ventral, 2–2–2, lateral, 2–2–2, thin scopula on metatarsus, II pair, spines same as on I pair, posterior pairs spiny; *palpus* as long as cephalothorax, tibia longer than patella and longer than cymbium, tibial apophysis rather small, with a truncate tip, embolus a short slender spine hidden between two longer parts each side.

Holotype ♂ Dom. Rep.; San José de las Matas, 1,500 feet, June 1938, (Darlington)

The sexes of *Ctenus* differ greatly in size, arrangement of eyes, number and position of the spines on the legs. *Ctenus insulanus* has paired dark spots on the abdomen as in *Ctenus hiemalis*, but as they were collected at different seasons of the year, and from widely separated localities, one at sea level and the other at 1,500 feet elevation, they are probably different species.

CTENUS MANNI spec. nov.

Figure 83

Female. Length, 11.5 mm., ceph. 4.7 mm. abd. 8.0 mm.

Cephalothorax reddish-brown, with no median pale stripe but streaked with a darker brown, anterior margin very little narrowed, thoracic groove long and deep and very near to posterior margin; *eyes* in three rows, a.m.e. small, separated by more than a diameter, a.l.e. smallest of the eight, and with the p.m.e. form a straight line, a.l.e. as near to p.m.e. as to p.l.e., eyes of posterior row subequal, each eye surrounded by black, p.m.e. separated by little more than a diameter, and from p.l.e. by about two diameters, p.l.e. on a low tubercle; *quadrangle* narrower in front and higher than wide; *clypeus* about equals a radius of a.m.e.; *mandibles* reddish-brown, geniculate, boss small, fang groove slightly oblique, upper margin with three teeth, middle tooth largest, lower margin with five teeth, last tooth very small; *labium* longer than wide, lateral margins notched at basal third; *maxillae* twice as long as labium, sides parallel, *sternum* more than three-quarters as wide as long; *abdomen* brown, discolored by age, in life probably covered with short hairs and very short bristles as a few remain, a very narrow median pale stripe that reaches a little beyond the middle, venter mottled; *legs* much broken, brown with no indications of darker bands, anterior tarsi and metatarsi with a scopula of short iridescent hairs, spines, no dorsal spines on anterior tibiae, I pair, tibia, ventral, 2–2–2–2, distal pair very small, lateral, 1 pair, metatarsus, ventral, 2–2–2, no dorsal or lateral spines; *epigynum* wider than long, the characteristic shape of a broad convex, median lobe with chitinized margins and very narrow lateral tubes or openings each side of the lobe.

Holotype ♀ Haiti; Jacmel, (Mann)

CTENUS MONTICOLUS spec. nov.

Figure 82

Female. Length, 14.0 mm., ceph. 5.5 mm. long, 4.0 mm. wide, abd. 8.2 mm. long, 6.0 mm. wide.

Cephalothorax with deep brown lateral stripes from the eyes to the posterior margin and a pale median stripe with vague margins, a narrow pale lateral stripe above the margins, anterior margin not narrowed, moderately convex, thoracic groove long and deep; *eyes* in three rows, a.m.e. small, separated by a diameter, a.l.e. oval, smallest of the eight, and with the p.m.e. form a slightly procurved line, a.l.e. as near p.m.e. as to p.l.e., eyes of posterior row subequal, p.m.e. separated by less than a diameter and from p.l.e. by fully three diameters; *quadrangle* narrower in front, and higher than wide; *clypeus* below a.m.e. little more than a diameter of a.m.e.; *mandibles* dark brown with many hairs, geniculate, boss large, fang groove slightly oblique, upper margin with three contiguous teeth, lower margin with four teeth; *labium* longer than wide, lateral margins of basal third notched; *maxillae* about twice as long as labium, outer margins not emarginate; *sternum* more than three-quarters as wide as long; *abdomen* oval, base narrow, widest on posterior half, convex, dull brown with three pairs of darker spots formed by darker hairs, sides mottled, venter paler with small dark spots; *legs*, 4–1–2–3, all joints but tarsi with three dark bands, most distinct on ventral side, anterior tarsi and metatarsi with a thin scopula, spines, no spines on anterior patellae, no dorsal spines on anterior tibiae, I pair, tibia, ventral, 2–2–2–2–2, long and over-lapping, metatarsus, ventral, 2–2–2, basal and median long, no lateral or dorsal spines, II pair same as I pair; *epigynum* of the typical shape, area wider than long, a median convex area with strongly chitinized lateral margins.

Holotype ♀ Haiti; Furcy, Mt. Cabaio, 7,000 feet, 26 March 1940, (Folk)

This specimen may be one moult from maturity, as the posterior margin of the epigynum is not heavily chitinized, but it is similar to several figured by other authors. It has several distinct characters that separate it from other described species from Hispaniola, such as the strongly banded legs with the thin scopula on the anterior metatarsi and tarsi. Strand described a species from Haiti from a female. While he states that he has one adult and several immature specimens, the description of the epigynum is apparently based on an immature. Also, the figures given for the total length and the length of the cephalothorax are plainly in error.

Genus CUPIENNIUS Simon 1891

CUPIENNIUS SALLEI (Keyserling)

Figure 95

Ctenus sallei Keyserling, 1877, p. 685, pl. 8, fig. 53. "♀ Südamerika. In Mexico bei Veracruz und Cordova von Herrn Sale gesammelt."

Female. Length, 20.0 mm., ceph. 9.0 mm. long, 8.0 mm. wide, abd. 11.5 mm. long, 6.5 mm. wide.

Cephalothorax with a broad median yellow stripe from the p.l.e. which abruptly narrows at the thoracic groove and continues to the posterior margin, sides mottled with brown, a line of white hairs between median eyes, moderately high, convex, thoracic groove long; *eyes* do not cover anterior margin, a.m.e. separated by almost a diameter, a.l.e. more than half a diameter of a.m.e., second row of eyes procurved, p.m.e. and p.l.e. subequal, p.m.e. twice the diameter of a.m.e. and separated by more than a radius and from p.l.e. by almost a diameter and a half, p.l.e. on a low tubercle; *quadrangle* narrower in front and as high as wide; *clypeus* below a.m.e. vertical, about a diameter and a half of a.m.e.; *mandibles* vertical, reddish-brown of alternate dark and white stripes with long white hairs on the pale stripes, boss small and inconspicuous, fang groove oblique, upper margin with three teeth, middle tooth the largest, lower margin with four sub-equal strong teeth, fang heavy; *labium* longer than wide, basal half slightly narrower; *maxillae* not twice as long as labium, inner margin excavate; *sternum* not as wide as long, pointed in front of fourth coxae; *abdomen* brown, in life probably with many long hairs as a few remain, the two pairs of muscle spots with short white hairs, venter dull brown; *legs*, 1–2–4–3, brown, anterior tarsi, metatarsi and tibiae with scopula, not as heavy on posterior pairs, spines, no dorsal spines on anterior tibiae, I and II pairs, patella, retrolateral, 1, tibia, ventral, 2–2–2–2, distal pair short, other pairs long and slender, lateral, 2–2, metatarsus, ventral, 2–2–2, basal and median pairs heavy, lateral, 2–2; *epigynum* rather small for the size of the spider, area longer than wide, with three lobes filling the posterior two-thirds, with small round openings in the divisions of the lobes, the lateral margins fringed with long hairs.

♀ Haiti; Momance, November 1912, (Mann)
♀ Haiti; Diquini, November 1912, (Mann)
♀ Dom. Rep.; Los Limones, 30 June 1938, (Darlington)

Subfamily CALOCTENINAE

Genus ODO Keyserling 1887

ODO HURSTI spec. nov.

Figure 87

Male. Length, 7.0 mm., ceph. 3.6 mm. long, 3.0 mm. wide, abd. 3.5 mm. long.

Cephalothorax yellow, with broad dark lateral stripes which contain three pairs of irregular darker spots over the posterior coxae, an irregular dark marginal stripe and a long dark line over thoracic groove, cephalothorax almost as wide as long, anterior margin narrowed to about half the greatest width, moderately convex, thoracic groove long, smooth with a few white hairs about the eyes; *eyes* do not cover anterior margin, both rows of eyes recurved, a.m.e. convex, largest of the eight, separated by a little over a radius, a.l.e. as near to a.m.e. as to p.m.e., a.l.e. more than a radius of a.m.e., posterior row longer than anterior, eyes subequal, p.m.e. separated by a little more than a diameter and from p.l.e. by about two diameters, p.l.e. on a low tubercle directed backward; *quadrangle* higher than wide and the same width in front as behind; *clypeus* as high as diameter of a.m.e.; *mandibles* pale, streaked with brown, vertical, no boss, fang groove oblique, upper margin with two large teeth, lower margin with three very small teeth; *labium* wider than long, basal half of lateral margins slightly notched, tip truncate; *maxillae* more than twice as long as labium, outer margins parallel, not emarginate; *sternum* pale, mottled with brown, darkest about the margins, as wide as long, convex, fourth coxae separated by less than half a diameter; *abdomen* pale, marked with dark gray, on distal half a very irregular median dark stripe, venter pale with a small median dark stripe; *legs* broken, left III and IV missing, 4–1–2–3, long and slender, pale with irregular dark bands on femora and tibiae, spines, I pair, femur, dorsal, 1–1–1, lateral, 3–3, patella, 0, tibia, dorsal, 1–1, lateral, 2–2, ventral, 2–2–2, metatarsus, ventral, 2–2, lateral, 2–2, II pair same as I pair, no scopula on tarsi, metatarsi or tibiae; *palpus* as long as cephalothorax, slender, tibia curved, chitinized and longer than patella, a strong dorsal spine about the middle near base and a larger tibial apophysis more than half the length of the joint, spatulate and protruding, distal apophysis a slender spur below the cymbium, terminal joint not quite as long as tibia, bulb fills lower half and rests on the tibia, a broad bifid piece on retrolateral side about the middle, distal half with a large chitinized spur which may be the embolus, above a broader membranous piece.

Holotype ♂ Dom. Rep.; Puerto Plata, April–May 1941, (Hurst)

The genus *Odo* was erected in 1887 by Keyserling on a female probably collected by J. McNeill from Nicaragua. This is in the Museum of Comparative Zoology. The specimen is still intact but brittle from age. In 1891, Keyserling placed two more species, both males from Brazil, in this genus.

Odo hursti differs from the genotype, in the large anterior median eyes but it agrees with the figures of the two males from Brazil, described by Keyserling. These have a curved tibia of the palpus and a large tibial apophysis. Unfortunately the figures of the palpi of the Brazilian species are small and do not show details. It agrees with the description of *Odo agilis* Simon from St. Thomas with no scopula on the tarsi, metatarsi and tibiae. The genotype, which is a female, has a thin scopula on these joints, but this may be a sexual character.

Genus TRUJILLINA gen. nov.

Cephalothorax longer than wide, anterior margin narrowed, moderately high, thoracic groove long and deep; *eyes* in three rows, a.m.e. small, separated by about a diameter, a.l.e. largest of the eight, as near p.m.e. as to a.m.e., posterior row recurved, p.m.e. slightly larger than p.l.e.; *quadrangle* narrower in front, and higher than wide; *clypeus* twice the diameter of a.m.e.; *mandibles* geniculate, boss small, upper margin of fang groove with two teeth, lower margin with two widely separated teeth; *labium* little wider than long; *legs*, 4–1–2–3, anterior tarsi and metatarsi scopulate, spines, no dorsal spines on anterior tibiae, I tibia, ventral, 12–11, no lateral, all spines from a raised base, long and over-lapping, metatarsus, ventral, 6 pairs of spines, no dorsal or lateral; male not known.

Genotype *Trujillina spinipes* spec. nov.

The genus *Trujillina* is separated from the genus *Ctenus* by the large a.l.e., higher clypeus, number of teeth on the fang groove, and the number of spines on the anterior tibiae and metatarsi. It is separated from *Caloctenus* by the large a.l.e., low thoracic portion, number of teeth on the fang groove, and the spines on the anterior tibiae and metatarsi.

TRUJILLINA SPINIPES spec. nov.

Figures 84, 85

Female. Length, 9.5 mm., ceph. 4.0 mm. long, 3.2 mm. wide, abd. 5.5 mm. long, 4.0 mm. wide.

Cephalothorax brown, radial striae darker, moderately convex, anterior margin little more than half the greatest width, thoracic groove long and deep, with area each side convex; *eyes* do not cover the anterior margin, both rows strongly recurved, a.m.e. smallest of the eight, separated by about a diameter, a.l.e. largest of the eight, separated by about two diameters, posterior row, p.m.e. little larger than p.l.e., separated by less than a diameter and from p.l.e. by a little more than a diameter, p.l.e. on a low tubercle and directed backward, a.l.e. as close to p.m.e. as to a.m.e.; *quadrangle* narrower in front and as high as wide; *clypeus* below a.m.e. twice the diameter of a.m.e.; *mandibles* deep brown, covered with long bristles, vertical, geniculate, boss small, fang groove oblique, upper margin with two sharp teeth, lower margin with two small widely separated teeth, fang long; *labium* a little wider than long, tip not narrowed; *maxillae* more than twice as long as labium, sides parallel, retromargin not emarginate; *sternum* pale, as wide as long, slightly convex, fourth coxae almost touching; *abdomen* oval, base narrow, widest posterior to middle, deep yellow, in life probably covered with short hairs and short stiff bristles as a few hairs and bristles remain, no pattern, venter pale with dark hairs; *legs*, I left missing, 4–1–2–3, brown, femora with broad dark bands, scant scopula of short iridescent hairs on anterior tarsi and metatarsi, spines, all ventral spines long, over-lapping and from a raised base, I pair, patella, 0, tibia, ventral, 12p.–11r., no dorsal or lateral, metatarsus, ventral, six pairs, no dorsal or lateral, II pair, tibia, ventral, 8 pairs, metatarsus, ventral, five pairs, III pair, tibia, ventral, two pairs, lateral, two pairs, metatarsus, ventral, two pairs, 1 median distal, IV pair, tibia, ventral, three pairs, lateral, four pairs; *epigynum*, the chitinized area wider than long, a pair of oval sacs that protrude from the area, about touching on the median line, with openings at posterior part in small lobes as figured.

Holotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Paratype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June, 1938 (Darlington)

Family GNAPHOSIDAE

Genus CARIDRASSUS Bryant 1940

CARIDRASSUS MAGNUS spec. nov.

Figure 90

Male. Length, 5.5 mm., ceph. 2.4 mm. long, 1.3 mm. wide, abd. 3.0 mm. long.

Cephalothorax brown, darker about margins, moderately convex, eye area elevated, anterior margin narrowed, no thoracic groove but a faint depression; *eyes,* the two rows well separated, anterior row about straight, a.m.e. smallest of the eight, separated by more than a diameter, a.l.e. largest of the eight, and separated from a.m.e. by less than a diameter of a.m.e., posterior row longer than the anterior, slightly recurved, eyes equidistant, p.m.e. angular, separated by the long diameter, lateral eyes separated by fully a diameter of a.l.e.; *quadrangle* higher than wide and wider behind than in front; *clypeus* higher than the diameter of a.m.e. with several long bristles on the margin; *mandibles* dark brown, vertical, long and narrow, fang groove oblique, no teeth on the lower margin, fang short; *labium* pale, longer than wide, tip only slightly narrower than the base; *maxillae* pale, not twice as long as labium, only slightly inclined, upper outer margin turned out, plainly impressed; *sternum* pale, oval, nearly twice as long as wide, (9.5 : 5.5), convex, with many dark hairs; *abdomen* oval, a dull gray with two pairs of broken pale bars, neither of which meet in the middle, the first pair, basal, and the second about the middle, includes the second pair of muscle spots, a basal scutum that extends to second pale bar, entire abdomen covered with short dark hairs, venter pale, spinnerets, long, ventral pair widely separated, dorsal pair little longer than the ventral; *legs,* 1–2–4–3, femora dark, other joints pale, spines, III and IV tibiae with dorsal basal spine, no patellae spines, I pair, tibia, ventral, 2 basal, 1 median, metatarsus, ventral, 2 basal, II pair, left leg has evidently been renewed as it is shorter than the right leg and has a different number of spines, II right, tibia, ventral, 2 distal, 1 median, 1 near the base, metatarsus, ventral, 1 basal, II left, tibia, ventral, 1 distal, metatarsus, ventral, 0, posterior pairs with many ventral spines on tibiae and metatarsi; *palpus,* as the spider has recently moulted, the parts are but little chitinized, not as long as cephalothorax, tibia and patella both short, about as long as the diameter of the joint, tibial apophysis extends to about the middle of the cymbium, tip truncate and turned outward, at the end of the bulb, two colorless lobes, the inner one smaller.

Holotype ♂ Haiti; Miragoane, 2 November 1934, (Darlington)

The genus *Caridrassus* is based on a female from Cuba, much smaller than *Caridrassus magnus.* The differences between the two may be sexual, but there is a possibility that they belong to separate genera, as the genotype *C. wheeleri* has no dorsal basal spine on the third and fourth tibiae and fewer ventral spines on the anterior tibiae. Both have no teeth on the lower margin of the fang groove and the arrangement of eyes is the same.

Genus POECILOCHROA Westring 1874

POECILOCHROA INCONSPICUA spec. nov.

Figure 91

Female. Length, 5.1 mm., ceph. 2.1 mm. long, 1.6 mm. wide, abd. 3.0 mm. long, 1.7 mm. wide.

Cephalothorax chestnut-brown, shaded with a dark gray, rather low, anterior margin about half the greatest width, thoracic groove distinct; *eyes* cover the middle half of the anterior margin, anterior row straight, eyes equidistant, a.m.e. black, separated by more than a radius, a.l.e. largest of the eight, posterior row slightly longer than the anterior row, recurved, p.m.e. oval, oblique, separated by more than a diameter, p.l.e. only slightly smaller than a.l.e. and separated from p.m.e. by a diameter and a half of p.l.e.; *quadrangle* the same width in front as behind, and higher than wide; *clypeus* about as high as the diameter of a.m.e., with several long bristles on the margin; *mandibles* a deep reddish-brown, vertical, rather small, fang groove oblique, very short, no teeth on the lower margin; *labium* reddish-brown, longer than wide; *maxillae* reddish-brown, one and a half times as long as labium, very much curved, so that tips almost touch; *sternum* oval, almost as wide as long, (7.0 : 8.0), very convex, fourth coxae almost touching; *abdomen* yellowish-gray, oval, dorsum flattened, covered with long and short hairs, venter pale, spinnerets, ventral pair large, separated by more than two diameters, dorsal pair no longer than ventral; *legs*, III right missing, 1–4–2–3, brown, spines, I pair, patella, 0, tibia, 0, metatarsus, ventral, 2 basal, 2 distal, II pair tibia,, ventral, 1 distal, metatarsus, same as first pair, posterior pairs with dorsal, lateral and ventral spines; *epigynum* as wide as long, and covered with hairs, a pair of circular sacs beneath the surface, separated by more than two diameters, directly anterior to the fold, anterior are large oval spaces with chitinized margins, separated by a median septum, with a pair of small circular openings directly below the margin, a median lobe nearer the pedicel.

Holotype ♀ Haiti; Ennery, 7 September 1934, (Darlington)

Paratype ♀ Dom. Rep.; south side of Lake Enriquillo, 14 September 1934, (Darlington)

It is possible that *Poecilochroa inconspicua* is the female of *P. minuta* Banks. The latter was based on a male from Brazos County, Texas, and a male has since been found by sweeping at Soledad, Cuba.

Genus TEMINIUS Keyserling 1887

TEMINIUS INSULARIS Keys.

Figures 92, 93

Teminius insularis Keyserling, 1887, p. 421, pl. 6, fig. 1. "♀ Haiti."

Female. Length, 20.0 mm., ceph. 6.5 mm. long, 4.2 mm. wide, abd. 11.0 mm. long.

Cephalothorax reddish-brown, with many short black fine hairs and a few short white hairs about the eyes and the lateral margins, widest between the third pair of legs, not very convex, anterior margin not much narrowed, thoracic groove long and distinct; *eyes* in middle half of anterior margin, anterior row about straight, a.m.e. largest of the eight, separated by less than a diameter and from a.l.e. by about a radius of a.m.e., posterior row slightly longer than anterior row, very slightly procurved, eyes subequal, p.m.e. separated by fully two diameters and from p.l.e. by a little more, lateral eyes separated by a radius; *quadrangle* higher than wide and a little wider behind than in front; *clypeus* equals more than a diameter of a.m.e.; *mandibles* geniculate, distinct boss, covered with long black bristles, fang groove oblique, upper margin with three teeth, middle tooth the largest, lower margin with two widely separated teeth, fang long with a heavy base; *labium* longer than wide, tip rebordered, lateral margins at basal third excavate; *maxillae* about twice as long as labium, impressed; *sternum* red-brown, convex, about two-thirds as wide as long, with many black hairs, ending in a point in front of the fourth coxae; *abdomen* cylindrical, a brownish-gray, covered with long and short hairs, no markings, venter pale; *spinnerets* upper pair longest, two jointed, lower pair short and separated by more than a diameter; *legs*, 4-1-2-3, all tarsi and metatarsi with a thick iridescent scopula, all joints with short black hairs, spines, I pair, femur, dorsal, median, 2, ventral, 0, patella, 0, tibia, dorsal, 0, ventral, 2 basal spines, long and slender, metatarsus, ventral, 1 median, short and stout at base, II pair, tibia, ventral, 1-1r, metatarsus, ventral, 1 basal, median, posterior pairs, tibiae and metatarsi with many spines; *epigynum* rather small for the size of the spider, anterior half a white fan-shaped depressed area, posterior half heavily chitinized, with dark curved lines each side in which are small openings.

Male. Length, 10.0 mm., ceph. 5.5 mm. long, 4.0 mm. wide, abd. 5.3 mm. long, 3.0 mm. wide.

Cephalothorax chestnut-brown, darker about the eyes and margins, a broad middle area from the eyes to groove much paler, cephalic portion moderately high, anterior margin only slightly narrowed, sides rounded and covered with short dark hairs, short white hairs and long bristles about the eyes, thoracic groove long and distinct; *eyes* cover middle half of the anterior margin, anterior row about straight, eyes equidistant, a.m.e. largest of the eight, separated by more than a radius, posterior row slightly procurved, very little longer than the anterior row, eyes equidistant, p.m.e. little smaller than a.m.e., separated by almost a diameter and a half, lateral eyes subequal and separated by less than a diameter; *quadrangle* narrower in front and higher than wide; *clypeus* equal to about a diameter of a.m.e.; *mandibles* dark reddish-brown, with many long bristles, vertical, long, no boss, fang groove oblique, upper margin with three equidistant teeth, middle tooth largest, lower margin with two small teeth, fang long; *labium* dark brown, longer than wide, lateral margins of basal third notched, tip very little narrower than base, and emarginate; *maxillae* very lightly impressed, not twice as long as labium, slightly inclined; *sternum* brown, convex, only little longer than wide, (8.5 : 7.0), with many long hairs, fourth coxae separated by about half a diameter; *abdomen* dark, with a long median lanceolate pale stripe, distal half with eight pairs of diagonal dark bars that do not meet in the middle, dark area with long dark hairs, the pale median stripe in life probably covered with short white hairs, venter pale, with few short hairs, spinnerets at tip, ventral pair short and truncate, separated by more than a diameter, dorsal pair long, two jointed, distal joint as long as basal, slender and pointed; *legs*, 4–1–2–3, pale, with many short hairs, anterior tarsi and metatarsi heavily scopulate, posterior tarsi only scopulate, posterior trochanters notched, few spines on anterior pairs, no patellae spines, spines, I pair, femur, dorsal, 1–1, prolateral, 1–1, tibia, dorsal, 0, ventral, 2–2, basal and submedian, retrolateral, 1, distal, metatarsus, ventral, 2 basal, II pair, femur, dorsal, 1–1, prolateral, 1–1–1, tibia, ventral, 1–1, median and basal, 1 distal, metatarsus, basal, 2, posterior pairs, many dorsal and ventral spines, tibiae, dorsal, basal and median; *palpus*, not as long as cephalothorax, slender and terminal joint small, femur with a retrolateral row of long bristles, patella + tibia as long as femur, tibia about twice as long as patella, tibial apophysis shorter than diameter of the joint with anterior margin serrate, cymbium not quite as long as tibia, embolus long, slender and dark with tip beyond the cavity, conductor slender and colorless on prolateral margin, parallel to the embolus with tip curved outward, the prolateral margin of the cavity with a fringe of long colorless hairs.

Holotype ♀ Haiti; (Uhler)
Allotype ♂ Haiti; Ennery, 7 September 1934, (Darlington)
2 ♂ pullus, ♀ Haiti; Ennery, 7 September 1934, (Darlington)
♀ Haiti; Ennery, 10 September 1934, (Darlington)

Keyserling based the genus *Teminius* on this species. The type, a female was probably collected by Dr. Uhler in 1873, from Grand Anse, and sent with other spiders to Keyserling. The genus was placed in the family *Drassidae*, (*Gnaphosidae*), because of the impressed maxillae and the separated anterior spinnerets.

The type specimen, now in the museum collection, is probably one or possibly two moults from maturity, although the cephalothorax is about as long as the specimen from Ennery, described above. The mandibles are smaller and not geniculate, and the anterior pairs of legs are spineless. The difference between the male and female is quite striking. The female is much larger and has no pattern on the abdomen, but the male has a median pale stripe with four pale chevrons on the posterior half. The anterior tibiae of the female have long slender spines that are not paired on the second tibia. In the male the spines are much heavier. The immature females have no spines on the anterior tibiae.

The genus has been wrongly synonymized by Simon with the genus *Syrisca*, (*Clubionoidae*). Because of the impressed maxillae and the separated spinnerets, *Teminius* clearly belongs with the *Gnaphosidae*, as placed by Keyserling.

TEMINIUS MONTICOLUS spec. nov.

Figure 94

Female. Length, 12.5 mm., ceph. 6.0 mm. long, 4.4 mm. wide, abd. 6.2 mm. long, 3.6 mm. wide.

Cephalothorax brown, darker about the eyes, shining, with a few short hairs, cephalic portion high and much narrower than the thoracic, thoracic groove long and deep; about one-third nearer the posterior margin than to the anterior; *eyes* cover middle two-thirds of the anterior margin, anterior row recurved, eyes subequal, a.m.e. separated by a little less than a diameter and from a.l.e. by a little less than a radius, posterior row straight, longer than the anterior, p.m.e. larger than a.m.e., separated by less than a diameter, p.l.e. little larger than p.m.e. and separated from them by fully a diameter of a.m.e.; *quadrangle* narrower in front and higher than wide; clypeus little higher than diameter of a.m.e.; *mandibles* darker than cephalothorax, vertical, geniculate, with many long bristles and short iridescent white hairs, boss small, fang groove oblique, upper margin with three teeth, the third from the base of the fang very small, lower margin with two subequal teeth, fang rather short; *labium* dark brown, longer than wide, lateral margins on basal half emarginate with a circular pit each side about midway between the base and tip; *maxillae* brown, about twice as long as labium, slightly inclined, and strongly impressed; *sternum* brown, convex, slightly longer than wide, (7.0 : 6.0), ending in a point in front of the fourth coxae, lateral margins slightly emarginate; *abdomen* oval, brown, middle area paler and on posterior half vague chevrons, entire abdomen covered with short hairs, venter paler, with many hairs; ventral spinnerets separated, tips truncate, dorsal spinnerets long, two jointed with distal joint as long as basal; *legs*, 4–1–2–3, long and slender, brown, no dark rings, rows of dark hairs and shorter white hairs that are iridescent in some lights, all tarsi scopulate, anterior metatarsi with a thick scopula, III and IV trochanters notched, spines, no patellae spines, I pair, femur, dorsal, 1 long and slender spine, prolateral, 1–1 distal, ventral, 0, tibia, dorsal, 0, lateral, 0, ventral, 2–2–2, basal and median pairs long and slender, distal pair short, metatarsus, dorsal, 0, lateral, 0, ventral, 2–2, hidden in the scopula, II pair, femur, dorsal, 1, prolateral, 2, p.1, tibia, ventral, 2 distal, r. 1–1, metatarsus, ventral, 2–2, posterior pairs, tibiae, 1 small dorsal basal spine, many ventral spines; *epigynum* a very heavily chitinized pair of tubes below the surface, almost touching on the median line, openings, a pair of small oval, oblique openings widely separated above the tubes and separated by a small lobe.

Holotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Teminius monticolus has a much larger epigynum than other members of the genus and apparently quite different, but the other structural characters agree with the genotype.

Family SPARASSIDAE

Subfamily SPARIANTHIDINAE

Genus STASINA Simon 1877

STASINA SAETOSA spec. nov.

Figure 99

Female. Length, 12.5 mm., ceph. 4.5 mm. long, 4.0 mm. wide, abd. 8.5 mm. long, without spinnerets, 5.0 mm. wide.

Cephalothorax yellow with dark spots arranged in lines directed towards the groove, each spot the base of a short bristle, moderately convex, anterior margin about two-thirds the greatest width, thoracic groove short; *eyes* do not cover the anterior margin, anterior row very slightly procurved, a.m.e. diurnal, separated by more than a diameter, a.l.e. smaller than a.m.e. and separated from them by almost two diameters, posterior row little longer than anterior, procurved, eyes equidistant and subequal, lateral eyes separated by more than a diameter of p.l.e.; *quadrangle* wider behind, and as high as width in front; *clypeus* below a.m.e. little more than a diameter of a.m.e.; *mandibles* yellow, with rows of dark bristles, geniculate, boss rather small, fang groove oblique, upper margin with three strong teeth, lower margin with two very small widely separated teeth; *labium* pale, wider than long, margins of basal third deeply notched; *maxillae* pale, parallel, twice as long as labium; *sternum* pale, as wide as long, widest between second coxae; *abdomen* oval, convex, a dull yellow with small irregular dark spots that form vague chevrons on posterior half, many short bristles, venter with fewer dark spots, spinnerets small, contiguous on a common base; *legs*, 4–2–1–3, not varying much in length, dull yellow with many dark spots, a ventral scopula of iridescent hairs on tarsi and metatarsi, spines, no patellae spines, I tibia, ventral, 2–2–2, long and overlapping, no apical, lateral, 2–2, opposite distal and basal pairs, dorsal, 0, metatarsus, ventral, 2 basal, very long, lateral, 1–1, near base, II pair same as first pair; *epigynum*, area longer than wide, a large median oblong convex lobe, with heavily chitinized margins above the fold, with a pair of circular depressions near the posterior margin and a pair of smaller circular openings at anterior end of the lobe; beneath the surface on each side are twisted and coiled tubes that lead to large sacs in the anterior part, these sacs separated by less than a diameter.

Holotype ♀ Dom. Rep.; Mt. Diego de Ocampo, north range, 3,000–4,000 feet, July 1938, (Darlington)

Stasina saetosa is separated from the two species found in Cuba, by the larger size, different spining on the anterior tibiae, and the epigynum.

Subfamily MICROMMATINAE

Genus OLIOS Walckenaer 1837

OLIOS ANTIGUENSIS (Keys.)

Sparassus antiguensis Keyserling, 1880, p. 264, pl. 7, fig. 146. "♂ ♀ Antigua"

♀ pullus Haiti; Port-au-Prince, (Crew), Banks Coll.

Subfamily HETEROPODINAE

Genus HETEROPODA Latreille 1804

HETEROPODA VENATORIA (Linn.)

Aranea venatoria Linnaeus, 1767, p. 1035. "in America calidiore"

♀ Haiti; Cap Haitien, January 1913, (Mann)
♀ Haiti; Port-au-Prince, July 1941, (Audant)
♂ 3♀ Dom. Rep.; Puerto Plata, July 1941, (Sosua)

Family SELENOPIDAE

Genus SELENOPS Latreille 1819

SELENOPS INSULARIS Keyserling

Selenops insularis Keyserling, 1881, p. 311, pl. 11, fig. 28. "♀ Porto Rico, Westindien."

♀ Haiti; Port-au-Prince, (Crew), Banks Coll.
♂ ♀ Haiti; Grand Anse, 1873, (Uhler)
♂ Haiti; Kenskoff, 4,500–5,500 feet, 2 September 1934, (Darlington)

SELENOPS TRIFIDUS spec. nov.

Figures 98, 100

Male. Length, 8.0 mm., ceph. 4.0 mm. long, 4.5 mm. wide, abd. 4.5 mm. long, 3.0 mm. wide.

Cephalothorax yellow, radial striae darker, with many short white hairs and long dark bristles about the margins, very flat, wider than long, anterior margin abruptly narrowed, thoracic groove deep; *eyes* cover anterior margin, the four median eyes form a recurved line, eyes equidistant, convex, a.m.e. smaller than a.l.e., p.m.e. oval, flat as near p.l.e. as to a.l.e., p.l.e. largest of the eight, convex, on a low tubercle and directed backward; *clypeus* below a.m.e. less than a diameter of a.m.e.; *mandibles* brown, vertical, with many long bristles, fang groove oblique, upper margin with three teeth, the third from the base of the fang very small, lower margin with two well separated teeth; *labium* longer than wide, lateral margins on basal half slightly notched; *maxillae* more than twice as long as labium, inner margins parallel; *sternum* pale, convex, almost circular, tip in front of the fourth coxae bilobed; *abdomen* oval, pale, a basal lanceolate dark stripe, dark about the spinnerets, dorsum covered with white hairs, venter pale, spinnerets closely grouped; *legs*, 4–2–3–1, IV right missing, I left has been renewed and is much shorter than leg on opposite side, legs pale, with no dark marks, spines, no patellae spines, I and II pairs, tibia ventral, 2–2–2–2, distal pair very small, others long and overlapping, lateral, 2–2, metatarsus, ventral, 2–2, lateral, 2–2; *palpus* about as long as cephalothorax, patella as long as wide, tibia not quite as long as patella, tibial apophysis two-thirds length of the joint, quite broad, tip with three blunt points, a shorter ventral membranous apophysis with a broad rounded tip, prolateral side of the tibia at distal end smooth and shining, palpus of the usual *Selenops* type, the conductor of the "pick-ax" type with the branch towards the middle turned outward, the hook at the base of the conductor long and slender with the tip hooked and bent outward.

Holotype ♂ Navassa Island, 1–9 November 1930, (Clench, Schevill and Rehder)

Selenops trifidus belongs to the first division of the genus as defined by Simon, with *Selenops radiatus* (Lucas) as the type. The four median eyes form a slightly recurved row with the a.m.e. smallest, the first tibia with three ventral pairs of long spines and two pairs of ventral spines on the metatarsus.

Family THOMISIDAE

Subfamily STEPHANOPSINAE

Genus ISALOIDES F.O.P.-Cambridge 1900

ISALOIDES TOUSSAINTI Banks

Isaloides toussainti Banks, 1903, p. 343, pl. 15, fig. 3. "♀ Haiti; Port-au-Prince, (Crew), Banks Coll."

Holotype ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

Allotype ♂ Cuba; Santiago de las Vegas, (Horne and Houser), Banks Coll.

♂ Haiti; Port-au-Prince, (Crew), Banks Coll.

♀ pullus Haiti; Diquini, November 1912, (Mann)

♂ pullus Haiti; hills near Port-au-Prince, 2 October 1934, (Darlington)

The immature specimens are easily identified, as both males and females have paired "warts" on the dorsum. The anterior lateral eyes are large and are on separated tubercles from the posterior lateral eyes.

Genus ONOCOLUS Simon 1895

ONOCOLUS VENUSTUS spec. nov.

Figures 101–104

Stephanopsis rugosa Banks, 1903; *nec Thomisus rugosa* Taczanowski, 1872.

Male. Length, 3.1 mm., ceph. 1.6 mm. long, 1.5 mm. wide, abd. 1.7 mm. long, 2.0 mm. wide.

Cephalothorax brown, with cream-color marks, anterior margin much narrowed, less than half the greatest width, and carried forward in a lobe, sides parallel, no thoracic groove, a triangular area slightly raised from the lateral eyes to near the posterior margin, area each side depressed, about the middle of the raised area, a group of three upright granules, radial striae marked by rows of granules and granules about the margins; *eyes* small, about cover the anterior lobe, anterior row strongly recurved, eyes about equidistant, a.m.e. smallest of the eight, separated by a little more than a diameter, a.l.e. largest of the eight, posterior row longer than the anterior, straight, eyes subequal, p.m.e. separated by fully three diameters and from p.l.e. by a diameter and a half, lateral eyes separated by at least two diameters of a.l.e.; *quadrangle* narrower in front and much higher than wide; *clypeus* pale, concave, as high as quadrangle, margin with a row of granules; *mandibles* brown, vertical, small, fang groove short, lower margin with two small teeth; *labium* brown, wider than long; *maxillae* brown, almost twice as long as labium, and slightly inclined; *sternum* brown, heart-shaped, four-fifths as wide as long, convex, fourth coxae separated by less than a diameter; *abdomen* a mottled brown with cream-color spots, pentagonal, flat, widest at distal third, anterior margin truncate, margins and dorsum thickly covered with granules, posterior angle blunt with a group of three tubercles, and posterior lateral angles with a group of two tubercles, no hairs or bristles, venter, middle triangular area pale, covered with short hairs, sides with granules, spinnerets near the tip, closely grouped, with a chitinous wall on the posterior half; *legs*, 1–2–4–3, short, anterior pairs much longer than posterior, all legs flattened on the dorsal and ventral sides, femora brown, I pair with three pale granules on prolateral margin, elsewhere with scattered granules, patella three-quarters as long as the tibia, tibia brown, with four pale granules on prolateral margin, spines, ventral, 2–2–2, long, all from a raised base, no hairs, metatarsus brown, with smaller granules, spines, ventral, 2–2–2, from a rasised base, basal and median pairs, long and overlapping, II pair similar to first pair, but fewer granules on femur, posterior pairs much shorter, pale, with granules, no spines but lateral rows of hairs; *palpus* not as long as cephalothorax, brown, cymbium pale and very thick, granules on distal half of femur, patella and a prolateral row on the tibia, patella and tibia of equal length, not equal to their diameter, tibial apophysis almost as long as diameter of the joint, slender, pressed close to the cymbium with the tip recurved, palpal organ fills the cavity, embolus a straight slender tube which ends at the tip.

Female. Length, 7.0 mm., ceph. 3.0 mm. long, 3.0 mm. wide, abd. 4.0 mm. long, 4.2 mm. wide.

Cephalothorax a deep tan-color with cream-color granules, anterior margin about half the greatest width, sides about parallel, quite flat, triangular raised area not as high as in the male, pale, granules about the margins, on radial striae and a few in the middle area but not as numerous as in the male; *eyes* cover middle third of the anterior lobe, eyes as in the male, but heavily ringed with white; *clypeus* sloping and not as high as the quadrangle; *mandibles* pale, vertical, small, fang groove with two small teeth on each margin; *labium* pale, slightly wider than long, tip narrowed; *maxillae* pale, not twice as long as the labium, inclined, so that the tips almost meet, palpi pale, patella and tibia of about equal length, flattened on dorsal side with a few pale granules on margins, tibia wider at the tip than at the base and the terminal joint large, triangular and flattened; *sternum* pale, two-thirds as wide as long; *abdomen* pale, pentagonal, widest at basal third, margins rebordered with white granules on the edge, dorsum flat with many small white granules, no hairs or bristles, venter, with area from the fold to the spinnerets smooth and hairy, sides with granules, spinnerets midway between fold and the tip, closely grouped and almost surrounded by a chitinous ring; *legs*, 1–2–4–3, pale, with white granules, anterior surface of first femur flattened, spines as in the male, but not as long; *epigynum* rather small for the size of the spider, pale, a lobe turned towards the pedicel with a clear area each side, near the tip of the lobe, a pair of elongate openings, separated by about their diameter, these are superimposed on large dark parallel tubes beneath the surface, touching on the median line, these extend posteriorly and gradually fade.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Allotype ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

Paratype ♀ San Domingo, Banks Coll.

Paratypes ♂ ♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)

Paratypes ♂s ♀ pullus Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Paratype ♂ Dom. Rep.; Cordillera Central, Loma Viega, south of Constanza, 6,000 feet, 28 August 1938, (Darlington)

There is great difference in size and color between the males and females of *Onocolus venustus* but both have the same arrangement of the eyes and a carapace of almost parallel sides. Moreover males and immature females have been found together. The species is apparently widely distributed over the island. It is separated from *Onocolus granulatus* Bryant, from the Sierra de Cebra, Cuba, known only from the male, by the more angulate cephalothorax and the palpus which is larger and much thicker. It undoubtedly belongs in the same genus with *Epicadus mutchleri* Petrunkevitch, known from a male and a female from Adjuntas, Puerto Rico, but it is separated from that species, by the larger palpus and the epigynum. In this latter species, both the male and female are described as dark.

Subfamily PHILODROMINAE

Genus GEPHYRINA Simon 1895

GEPHYRINA PUNCTATA spec. nov.

Figure 96, 97

Female. Length, 4.5 mm., ceph. 2.0 mm. long, 1.6 mm. wide, abd. 2.6 mm. long, 1.7 mm. wide.

Cephalothorax with a wide pale parallel sided stripe from the p.l.e. to the posterior margin, sides darker and punctate with darker dots, a few short dark bristles, quite low, sides evenly rounded, thoracic groove very short; *eyes* cover anterior margin, anterior row recurved, a.m.e. smallest, separated by more than two diameters, and from a.l.e. by about two diameters, posterior row longer than anterior, strongly recurved, p.m.e. nearer each other than to p.l.e.; *quadrangle* a little narrower in front than behind, and wider than high; clypeus convex, higher than quadrangle and covered with dark dots, a long bristle each side near the outer margin; *mandibles* pale, with small dark dots, vertical, weak, a strong bristle just below the base directed forward on each mandible, fang groove short; *labium* pale, longer than wide; *maxillae* not twice as long as labium, inner margins parallel, pale with dark dots on the outer margins; *sternum* pale with dots about the margins, almost as wide as long, (6.5 : 7.0), convex, with several long bristles about margins; fourth coxae separated by less than a diameter; *abdomen* an elongate oval, pale with a median basal spear mark that about reaches the middle, sides paler with many dark dots, a few scattered bristles, venter pale with dark dots most numerous in the middle area, several short bristles; *legs*, 2–1–4–3, pale with dark dots most numerous on the prolateral sides, scant scopula on tarsi and tips of anterior metatarsi, spines, I pair, femur, dorsal, 1–1, patella, prolateral, 1, tibia, ventral, 2–2–2–2, distal pair very short, others long and over-lapping, prolateral, 1–1, retrolateral, 1–1, dorsal, 1–1, the lateral and dorsal spines weak, metatarsus, ventral, 2–2, prolateral, 1–1, retrolateral, 1–1, II pair, same as I pair; *epigynum* area as wide as long, median area covered with short hairs, a long depression each side with a clear hyaline spot at the anterior end, and near the fold an oblong chitinized area which may be the opening.

Holotype ♀ Dom. Rep.; Cordillera Central, Valle Nuevo, south east of Constanza, 7,000 feet, August 1938, (Darlington)

The genus *Gephyrina* was based by Simon on an immature female from Venezuela, and two years later he described a second species, also an immature female, from St. Vincent. *Gephyrina punctata* apparently differs from these two, by the much higher clypeus, but it is not uncommon for the relative height of the clypeus and the position of the eyes to vary with each moult. It agrees with the definition of the genus in the weak lateral and dorsal spines on the anterior pairs of legs.

Subfamily MISUMENINAE

Genus MISUMENOPS F.O.P.-Cambridge 1900

MISUMENOPS BELLULUS (Banks)

Misumena bellula Banks, 1896, p. 71. "♀ Florida; Punta Gorda"

♀ Haiti; Grand Anse, 1873, (Uhler)
6♂ 3♀ Haiti; Diquini, November 1912, (Mann)
♀ Haiti; Ennery, 10 September 1934, (Darlington)
♂ ♀ pullus Haiti; hills north of Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)
♀ Haiti; foot hills north east of Massif de la Hotte, 3,000–4,000 feet, October 1934, (Darlington)
♀ Haiti; Port-au-Prince, July 1941, (Audant)

MISUMENA CELER (Hentz)

Thomisus celer Hentz, 1847, p. 446, pl. 23, fig. 5, reprint, p. 78, pl. 10, fig. 5. "♀ South Carolina, North Carolina, Massachusetts, Alabama, Ohio, etc."

2♂ ♀ Haiti; Diquini, November 1912, (Mann)
♂ ♀ Haiti; Trou Caiman, 4 September 1934, (Bates)
♂ ♀ Haiti; Kenskoff, 4,500 feet, 2 May 1935, (Roys)
♂ ♀ Dom. Rep.; San José de las Matas, 1,500 feet+, June 1938, (Darlington)

Family CLUBIONIDAE

Subfamily CLUBIONINAE

Genus CHIRACANTHIUM C. Koch 1859

CHIRACANTHIUM INCLUSUM (Hentz)

Clubiona inclusa Hentz, 1847, p. 451, pl. 23, fig. 18; reprint, p. 85, pl. 10, fig. 18. "♀ South Carolina; North Carolina, etc."

♂ Haiti; 1912–1913, (Mann)
♀ Haiti; Diquini, November 1912, (Mann)
♀ Haiti; hills near Port-au-Prince, 2,000 feet, 2 October 1934, (Darlington)
♂ Dom. Rep.; San Jose de las Matas, 1,500 feet+, June 1938, (Darlington)

Subfamily ANYPHAENINAE

Genus ANYPHAENA Sundevall 1833

ANYPHAENA LAUTA spec. nov.

Figure 107

Female. Length, 8.5 mm., ceph. 3.4 mm. long, 2.6 mm. wide, abd. 5.0 mm. long, 3.1 mm. wide.

Cephalothorax pale brown, moderately convex, anterior margin about half the greatest width, thoracic groove long; *eyes*, anterior row slightly recurved, a.m.e. very small, separated by less than a diameter, a.l.e. more than twice the diameter of a.m.e. and separated from them by less than a diameter of a.l.e., posterior row procurved, eyes subequal, p.m.e. separated by more than a diameter and from p.l.e. by less than a diameter; *quadrangle* narrower in front and higher than wide; *clypeus* about equals a diameter of a.m.e.; *mandibles* vertical, fang groove oblique, upper margin with six graduated teeth, lower margin with a row of granules; *labium* pale, longer than wide, tip slightly notched and only a little narrower than the base; *maxillae* pale, about one and a half times as long as the labium, outer margins parallel; *sternum* pale, heart-shaped, about two-thirds as wide as long, fourth coxae separated by less than a diameter; *abdomen* pale, oval, slightly mottled, venter pale, opening of the posterior spiracle about midway between the fold and the spinnerets, spinnerets closely grouped; *legs*, 1–2–4–3, left IV leg missing, pale, distal joints darker, anterior tarsi and metatarsi scopulate, spines long and dark, a slender spine at the tip of each patella, I pair, tibia, ventral, 2–2, basal and median, retrolateral, 1–1–1, prolateral, 1–1–1, metatarsus, ventral, 2–2, retrolateral, 1–1–1, prolateral, 1–1–1, II pair same as I pair, posterior tibiae with spines in whorls; *epigynum* small for the size of the spider, area wider than long, in the anterior portion an oval opening with the margin of the distal half heavily chitinized, a pair of transverse oval sacs beneath the surface, about touching on the median margin, with curved tubes from the upper outer margin and a circular opening where the tube leaves the sac, the entire area except for the openings covered with short colorless hairs.

Holotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Anyphaena lauta probably belongs to that section of the genus including *A. bispinosa* Bryant from Pico Turquino, Cuba of which both sexes are known. It differs from that species in the larger size, slight difference in the spacing of the eyes of the posterior row, the color, and the position of the opening of the posterior spiracle.

ANYPHAENA MODESTA spec. nov.

Figure 105

Female. Length, 7.0 mm., ceph. 2.6 mm. long, 2.1 mm. wide, abd. 4.5 mm. long, 3.2 mm. wide.

Cephalothorax pale, smooth, shining, anterior margin less than half the greatest width, thoracic groove distinct; *eyes* cover half the anterior margin, each eye surrounded by a heavy black ring, anterior row recurved, eyes equidistant, a.m.e. very small, less than a radius of a.l.e., separated by about a radius of a.m.e., posterior row slightly longer than the anterior, procurved, eyes subequal and larger than a.l.e., p.m.e. separated by almost a diameter and a half, and from p.l.e. by a diameter; *quadrangle* narrower in front and higher than wide; *clypeus* more than a diameter of a.m.e.; *mandibles* pale, vertical, no boss, fang groove oblique, upper margin of the groove with four teeth, lower margin with a few granules near the base of the fang, followed by a short carina; *labium* pale, two-thirds as wide as long, tip notched; *maxillae* pale, nearly twice as long as labium, sides parallel; *sternum* pale, oval, half as wide as long, pointed between the fourth coxae; *abdomen* pale, a broad oval, convex, venter pale, opening of the posterior spiracle about a third nearer the fold than to the spinnerets; *legs*, 1–2–4–3, pale, spines dark, spines, I pair, tibia, ventral, 2–2, prolateral, 1–1–1, retrolateral, 1–1–1, metatarsus, ventral, 2–2, prolateral, 1–1–1, retrolateral, 1–1–1, ventral spines very long, II pair same as I pair; *epigynum* area twice as wide as long, the spider has not oviposited, a large median oval depression with the anterior and lateral margins chitinized, anterior and separated by a broad septum, a pair of oval openings that connect with a pair of dark widely separated sacs beneath the surface just above the fold.

Holotype ♀ Haiti; foot hills north east of Massif de la Hotte, 3,000–4,000 feet, October 1934, (Darlington)

Paratype ♀ Haiti; foot hills, Massif de la Hotte, 3,000–4,000 feet, October 1934, (Darlington)

ANYPHAENA PUSILLA spec. nov.

Figure 108

Female. Length, 4.0 mm., ceph. 1.6 mm., abd. 2.6 mm.

Cephalothorax pale, much darker about the eyes and with irregular lateral dark stripes, moderately convex, thoracic groove distinct; *eyes*, anterior row straight, eyes equidistant, a.m.e. very small, separated by about a diameter, a.l.e. more than twice the diameter of a.m.e., posterior row little longer than anterior, procurved, p.m.e. slightly larger than p.l.e., separated by more than a diameter and from p.l.e. by a little less than a diameter; *quadrangle* narrower in front and higher than wide; *clypeus* below a.m.e. about a diameter of a.m.e.; *mandibles* vertical, brown, shaded with a darker brown, fang groove oblique, impossible to see the teeth on the fang groove; *labium* brown, longer than wide; *maxillae* pale brown, about one and a half times as long as the labium, outer margin parallel; *sternum* pale, two-thirds as wide as long, convex, a few long hairs on outer margins and at the tip; *abdomen* oval, pale, with irregular dark spots most numerous at the tip, covered with very short iridescent hairs, venter pale, openings of the posterior spiracle slightly nearer the spinnerets than to the fold; *legs*, 1–2–4–3, pale with vague dark rings on all joints, most distinct on the posterior pairs, distal joints of anterior pairs darker, spines long, I pair, tibia, ventral, 2–2, prolateral, 1–1, retrolateral, 1–1, metatarsus, ventral, 2–2, prolateral, 1–1, retrolateral, 1–1, II pair same as I pair; *epigynum*, area wider than long, a pair of dark transverse sacs anterior to the fold with openings at outer upper margins, a median opening nearer the pedicel with chitinized margins, entire area except for the openings covered with short dark hairs.

Holotype ♀ Dom. Rep.; Cordillera Central, Valle Nuevo, south east of Constanza, 7,000 feet, August 1938, (Darlington)

Anyphaena pusilla belongs to the section of the genus containing *Anyphaena bispinosa* Bryant, from Pico Turquino, Cuba. It is slightly smaller, and there is a slight difference in the spacing of the eyes of the posterior row; the opening of the posterior spiracle is nearer the middle of the abdomen, and the median opening of the epigynum is smaller and more widely separated from the paired dark sacs.

ANYPHAENA REMOTA spec. nov.

Figures 106, 111

Male. Length, 5.6 mm., ceph. 2.6 mm., abd. 3.1 mm.

Cephalothorax pale, anterior margin much narrowed, less than half the greatest width, widest between the second and third pairs of legs, moderately convex, thoracic groove faint; *eyes* cover three-quarters of the anterior margin, anterior row straight, eyes very unequal in size, eyes equidistant, a.m.e. very small, separated by less than a diameter, posterior row slightly procurved, little longer than anterior row, eyes subequal with a.l.e., p.m.e. separated by more than a diameter and from p.l.e. by less than a diameter; *quadrangle* very narrow in front, and as high as wide behind; *clypeus* very narrow below a.m.e., less than a diameter of a.l.e.; *mandibles* pale, vertical, and weak, fang groove oblique, upper margin with four teeth, third from the base of the fang the largest, lower margin with two small, well separated teeth, followed by a row of five very small granules, fang long; *labium* longer than wide, tip narrower than base and deeply notched; *maxillae* pale, almost twice as long as labium, sides parallel, on the retrolateral side a small lobe or tubercle over basal joint of the palpus, larger on the right maxilla than on the left; *sternum* pale, triangular, three-quarters as wide as long, ending in a broad lobe between the fourth coxae, fourth coxae with a basal retrolateral tubercle covered with dark spicules; *abdomen* pale, oval, twice as long as wide, ending in a point above the spinnerets, venter, opening of the posterior spiracle one-third nearer the fold than to the spinnerets; *legs*, 4–1–2–3, pale long and slender with long black spines, spines, I pair, femur, dorsal, median, 1–1–1, prolateral, 2, retrolateral, 2, ventral, 0, patella, dorsal, 1 short basal spine, 1 long distal bristle, tibia, dorsal, median, 1–1–1, ventral, 2–2, very long, basal and median, prolateral and retrolateral, 3–3, basal, median and a small distal, metatarsus, dorsal, 0, ventral, 2–2, basal and median, prolateral and retrolateral, 3–3, II pair same as the I pair, III pair, spines not modified, femur with a low ventral tubercle, one-third nearer base than the tip, covered with small dark spicules; *palpus,* left palpus missing, as long as cephalothorax, pale, femur slender with scattered ventral granules near base, patella fully twice as long as wide, with three long pale apophyses, two retrolateral, so that one can be seen from the dorsal side and one distal that extends onto the tibia, tibia longer than the patella, slightly bent, with a short retrolateral apophysis at the distal end and a long prolateral slender spine near the base that is about one-half the length of the joint, ventral surface smooth and shining with two dark cusps at the tip, cymbium longer than the tibia, palpal organ at the distal end, a large white leaf-like piece with a tube-like extension from which probably arises the embolus, in the center a long curving white piece and a narrow tube on both margins of the lower half.

Holotype ♂ Dom. Rep.; Mt. Diego de Ocampo, north range, 3,000–4,000 feet, July 1938, (Darlington)

Paratype ♂ Haiti; Ennery, 7 September 1934, (Darlington)

Anyphaena remota has several characters that are uncommon in the genus. The fourth pair of legs are longer than the first pair, and the maxillae has a distinct lobe on the retrolateral margin. The paratype from Ennery has the group of granules on the third pair of coxae, not the fourth, and a smaller group of granules on the second left coxa. The three long ventral and retrolateral apophyses on the patella of the palpus are found on *Anyphaena tricuspis* (Bryant) (Wulfila), from Cuba.

Genus ANYPHAENELLA Bryant 1931

ANYPHAENELLA FASCICULA spec. nov.

Figures 109, 110

Male. Length, 5.0 mm., ceph. 2.1 mm., abd. 2.8 mm., I tib. 5.0 mm. long.

Cephalothorax pale, darker about the eyes, moderately convex, anterior margin less than half the greatest width, thoracic groove long; *eyes* cover three-quarters the anterior margin, anterior row recurved, eyes equidistant, a.m.e. very small, separated by more than a diameter, a.l.e. about twice the diameter of a.m.e., posterior row longer than anterior, procurved, p.m.e. slightly largest of the eight, separated by more than a diameter and from p.l.e. by about a diameter, lateral eyes separated by more than a diameter of p.l.e.; *quadrangle* much narrower in front and higher than wide; *clypeus* below a.m.e. more than a diameter of a.m.e.; *mandibles* pale brown, vertical, fang groove oblique, with no teeth on either margin; *labium* longer than wide, tip narrowed and notched; *maxillae* twice as long as labium, sides parallel; *sternum* pale, triangular, three-quarters as wide as long, pointed between fourth coxae, fourth coxae separated by almost a diameter; third coxae with a short black spine on the prolateral margin, fourth coxae with a larger black spine; *abdomen* oval, pale, mottled with gray, tip darker but no definite pattern, venter pale, opening of posterior spiracle midway between fold and the spinnerets; *legs*, 1–2–4–3, pale with the distal joints darker, spines, I pair, femur, dorsal, 1–1–1, prolateral, 1–1–1, retrolateral, 1–1–1–1, ventral, 0, patella, 0, tibia, dorsal, 1–1–1, ventral, 2–2–2, long and slender, prolateral, 1–1–1, retrolateral, 1–1–1, a prolateral row of long trichobothria with recurved tips, a retrolateral row of shorter trichobothria, metatarsus, dorsal, 1–1–1, ventral, 2–2, very long, prolateral and retrolateral rows of trichobothria, spines on II pair same as on I pair, III pair with shorter trichobothria; *palpus* as long as cephalothorax, patella shorter than tibia, tip of the patella with a chitinized lobe and a very long dorsal basal bristle, tibia curved and near the base on the prolateral side in the excavate area, a cluster of long stiff bristles fully half as long as the joint, under low magnification these bristles appear as two or three spines, a very long dorsal basal bristle, terminal joint longer than the tibia, embolus a transverse spine near the tip, protected by a sheath.

Female. Length, 5.0 mm., ceph. 2.5 mm., abd. 3.0 mm., I tibia, 3.2 mm. long.

Cephalothorax pale, shaded with a light brown, two-thirds as wide as long, slightly convex, anterior margin little over half the greatest width, thoracic groove distinct; *eyes* cover about three-quarters of the anterior margin, anterior row slightly recurved, eyes equidistant, a.m.e. very small, separated by more than a diameter, a.l.e. at least twice the diameter of a.m.e., posterior row longer than anterior, eyes equidistant and subequal, p.m.e. separated by more than a diameter, lateral eyes separated by a diameter of p.l.e.; *quadrangle* narrower in front and higher than wide; *clypeus* below a.m.e. less than a diameter of a.l.e.; *mandibles* vertical, cone-shaped, fang groove short, no teeth on either margin of the groove; *labium* pale, longer than wide, sides parallel, tip notched; *maxillae* pale, not twice as long as labium, sides parallel; *sternum* pale, three-quarters as wide as long, fourth coxae separated by a diameter; *abdomen* oval, pale, opening of the posterior spiracle slightly in front of the middle; *legs*, 1–2–4–3, pale with faint darker bands on the tibiae and metatarsi, spines, I pair, femur, dorsal, 1–1–1, prolateral, 1–1–1, retrolateral, 1–1–1, ventral, 0, but a row of long trichobothria, patella, dorsal, 1 short basal spine, tibia, dorsal, 1–1, ventral, 2–2, very long, prolateral, 1–1–1, retrolateral, 1–1–1, metatarsus, ventral, 2–2, very long, prolateral, 1–1–1, retrolateral, 1–1–1, dorsal and ventral rows of trichobothria on tibia and metatarsus, II pair, spines the same as on I pair, scattered trichobothria on posterior pairs; *epigynum*, area slightly longer than wide, in posterior half a pair of dark sacs below the surface, almost touching, with curved ducts on outer side directed towards openings, openings probably a pair of hyaline circles on anterior portion of sacs.

Holotype ♂ Dom. Rep.; Cordillera Central, Loma Viega, south of Constanza, 6,000 feet, August 1938, (Darlington)

Allotype ♀ Dom. Rep.; north Cordillera Central, Loma Rucilla Mountains, June 1938, (Darlington)

Paratype ♂ Dom. Rep.; north Cordillera Central, Loma Rucilla Mountains, June 1938, (Darlington)

Paratype ♀ Dom. Rep.; Loma de la Pena, north west of Constanza, 5,000 feet+, 23 August 1938, (Darlington)

Paratype ♀ Dom. Rep.; Cordillera Central, rain forest north of Valle Nuevo, 6,000 feet, August 1938, (Darlington)

The genus *Anyphaenella* was based on two species found in the eastern and southern parts of the United States. Since then, others have been found in the West and in Cuba. The anterior pairs of legs are very long with the tibia of the first pair as long or longer than the entire length of the spider. The tibia of the male palpus is bent and on the excavate area near the base, there is either a pronounced lobe or spine. In *Anyphaenella fascicula* this area has a group of stout straight bristles that appear under a low magnification as two or three spines. The long curved trichobothria on the anterior tibiae and metatarsi are very conspicuous.

The genus is separated from *Teudis*, *Wulfila* and *Sillus*, by the much shorter maxillae that are not excavate on the outer side.

ANYPHAENELLA FRAGILIS spec. nov.

Figure 118

Female. Length, 4.5 mm., ceph. 1.9 mm., abd. 2.7 mm. long, 1.1 mm. wide.

Cephalothorax very pale, about two-thirds as wide as long, anterior margin half the greatest width, moderately convex, thoracic groove very faint; *eyes* cover about half the anterior margin, each eye heavily ringed with black, anterior row straight, a.m.e. very small, separated by a diameter, a.l.e. convex, fully three times the diameter of a.m.e. and separated from the a.m.e. by a diameter of a.l.e., posterior row slightly procurved, eyes subequal and equidistant, p.m.e. separated by a diameter and a half; *quadrangle* much narrower in front and slightly higher than wide; *clypeus* below a.m.e. about equals the diameter of a.l.e.; *mandibles* pale, vertical, fang groove oblique, upper margin with four small teeth, lower margin with a row of small granules; *labium* pale, almost twice as long as wide; *maxillae* pale, one and a half times as long as labium, sides parallel; *sternum* white, convex, almost as wide as long; *abdomen* pale, cylindrical, less than half as wide as long, no markings, no hairs, venter pale, opening of posterior spiracle about midway between fold and spinnerets; *legs*, much broken, 1–2–4–3, (?), pale, spines very slender and colorless, spines, I pair, patella, 1 at tip, tibia, ventral, 2–2, prolateral, 1–1, retrolateral, 1–1, dorsal, 0, metatarsus, ventral, 2–2–2, prolateral, 1–1–1, retrolateral, 1–1–1, II pair same as I pair; *epigynum*, area wider than long, shows little but two circular sacs beneath the surface, separated by less than a diameter and posteriorly a pair of slightly larger sacs very faintly defined.

Holotype ♀ Haiti; foot hills, northeast of Massif de la Hotte, 3,000–4,000 feet, October 1934, (Darlington)

ANYPHAENELLA GRACILIPES (Banks)

Figure 117

Anyphaena gracilipes Banks, 1903, p. 342, pl. 15, figs. 6, 10. "♀ Haiti; Port-au-Prince."

Female. Length, 6.0 mm., ceph. 2.0 mm., abd. 3.5 mm. long, 2.0 mm. wide.

Much darkened and broken by age.

Cephalothorax about two-thirds as wide as long, anterior margin less than half the greatest width, thoracic groove distinct; *eyes* cover more than half the anterior margin, anterior row straight, eyes equidistant, a.m.e. very small, separated by a diameter, posterior row slightly procurved, eyes subequal and equidistant; *quadrangle* narrower in front and higher than wide; *clypeus* below a.m.e. more than a diameter of a.m.e.; *mandibles* vertical, impossible to see teeth on the fang groove; *labium* longer than wide; *maxillae* one and a half times as long as labium, sides parallel; *abdomen* with no markings, opening of the posterior spiracle a little nearer the fold than to the spinnerets; *legs* much broken, 1–2–4–3, (?), spines, I pair, tibia, ventral, 2–2, prolateral, 1–1–1, retrolateral, 1–1–1, metatarsus, ventral, 2–2, prolateral, 1–1–1, retrolateral, 1–1–1, ventral spines very long; *epigynum*, area wider than long, a large median opening with obliquely coiled tubes below.

Holotype ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

The type is broken and dark with age, so that it is almost impossible to trace the parts of the epigynum, but "the two almond-shaped cavities" mentioned by Banks, are probably the coiled tubes near the surface. They may open near the posterior end.

Genus AYSHA Keyserling 1891

AYSHA FEROX Simon

Figure 115

Aysha ferox Simon, 1896, p. 507. "♀ Santo Domingo."

Male. Length, 13.0 mm., ceph. 6.0 mm. long, 4.5 mm. wide, abd. 8.0 mm. long, 3.8 mm. wide.

Cephalothorax pale, smooth, shining, a few long bristles in the eye area, thoracic groove distinct, a small cusp at the anterior lateral margin directed forward; *eyes* cover half of the anterior margin, anterior row recurved, eyes equidistant, subequal, separated by a diameter of a.m.e., posterior row slightly longer than the anterior, eyes subequal and equidistant; *quadrangle* narrower in front and not as high as wide behind; *clypeus* slightly wider than the diameter of a.m.e.; *mandibles* darker than the cephalothorax, porrect, distal half much narrowed with scattered short black spines, fang groove oblique, upper margin with four teeth, the third from the base of the fang close to the fourth tooth, lower margin with two widely separated teeth, smaller than teeth on the opposite margin, fang long; *labium* longer than wide, tip notched, lateral margins on basal third excavate; *maxillae* less than twice as long as labium, excavate on retrolateral side, with a black scopula at the tip; *sternum* pale, little more than half as wide as long; *abdomen* pale, a narrow oval, no markings, venter pale, opening of the posterior spiracle very near the fold; *legs*, 1–2–4–3, anterior pairs very long, pale, anterior tibiae and metatarsi scopulate, spines, I pair, tibia, ventral, 2–2–2, prolateral, 1–1–1, retrolateral, 1–1–1, metatarsus, ventral, 2 basal, prolateral, 1, retrolateral, 1; *palpus,* pale, longer than cephalothorax, tibia plus patella longer than femur, tibia more than twice as long as patella, (6.0 : 2.5), and about six times as long as wide, with long colorless hairs, tibial apophysis longer than the diameter of the joint, oblique, not touching cymbium, seen from the ventral side, the tip is prolonged in a lateral point, palpal organ of the familiar *Aysha* type, with the embolus confined to the distal two-fifths and encircling about half of the flat disc of the bulb, ending in a free tip in the median groove of the cymbium.

Allotype ♂ Dom. Rep.; Puerto Plata, August 1941, (Hurst) .

It is with some hesitation that this male is identified as *Aysha ferox* Simon, since the species was described from a female. The female is from 12.0–15.0 mm. long, which is much larger than the other species, and the eyes of the anterior row are subequal. My male can be separated from *Aysha tenuis* (L. Koch), also found in Haiti, by the longer and more slender tibia of the palpus.

AYSHA TENUIS (L. Koch)

Anyphaena tenuis L. Koch, 1866, p. 211, pl. 9, fig. 140. "♀ St. Domingo. Coll. Keyserling."
Aysha ravida Simon, 1896, p. 508. "♀ Santo Domingo."

♂ ♀ Haiti; Port-au Prince, August 1941, (Audant)
♂ ♀ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

AYSHA VELOX (Becker)

Anyphaena velox Becker, 1879, p. 83, pl. 1, figs. 5–7. "♀ Miss.; environs de Pascagoula."

♂ Dom. Rep.; Barahona, September 1938, (Darlington)

Genus TEMNIDA Simon 1896

TEMNIDA PARVULA (Banks)

Figures 112, 113, 119

Wulfila parvula Banks, 1903, p. 342, pl. 15, figs. 2, 4. "♂ ♀ Hayti; Port-au-Prince."

Male. Length, 3.2 mm. without mand., ceph. 1.5 mm. long, 1.0 mm. wide, abd. 1.7 mm., mand. 1.0 mm. long.

Cephalothorax brown, rather flat, two-thirds as wide as long, anterior margin very little narrowed, more than half the greatest width, thoracic groove distinct; *eyes* cover more than two-thirds the anterior margin, anterior row slightly recurved, eyes equidistant, a.m.e. small, about a radius of a.l.e. and separated from them by a diameter, posterior row a little longer than the anterior, eyes larger than a.l.e., subequal and equidistant; *quadrangle* narrower in front and higher than wide; *clypeus* below a.m.e. less than a diameter of a.m.e.; *mandibles* brown, smooth and shining, porrect, two-thirds as long as cephalothorax, boss small, outer margins parallel, inner margin narrowed to width of the fang, groove oblique, very long, upper margin with four small widely separated teeth and a scant scopula of long bristles, lower margin with no teeth, fang long; *labium* one and a half times as long as wide, sides parallel with a pit on lateral margins near the base, tip notched; *maxillae* almost twice as long as labium, inner margins parallel, outer margins emarginate, tip not much widened; *sternum* convex, tip pointed, fourth coxae separated by more than a diameter; *abdomen* pale, oval, narrow, opening of posterior spiracle midway between fold and spinnerets; *legs*, 4–1–2–3, pale with no markings, spines, I pair, femur, dorsal, 1–1–1, retrolateral, 1 at tip, patella, 0, tibia, ventral, 5–4, long and overlapping, very faint scopula on tarsus and metatarsus, II pair the same as I pair, III and IV pairs not modified; *palpus* as long as cephalothorax, pale, with terminal joint darker, tibia very little longer than patella, with a dorsal row of small black cusps ending with a group of four that extend towards the cymbium, tibial apophysis longer than the diameter of the joint, transparent and leaf-like, cymbium about one and a half times as long as tibia, bulb filling lower half of the cavity, upper half with a large dark curved strong spine that extends to the tip with two pale and insignificant smaller processes directly below, on the opposite side of the bulb, a long curving dark spine that rests against the larger and more prominent dark spine.

Female. Length, 2.7 mm. long.

Cephalothorax, eyes, labium, maxillae and *sternum* the same as in the male, *mandibles* brown, geniculate, fang groove short; *abdomen* as in the male; *legs*, 4–1–2–3, shorter than in the male, the same arrangement of spines but the spines much heavier, basal pair on the I metatarsus three-quarters as long as the joint; *epigynum*, area wider than long, middle area with oblique tubes and widely separated openings.

Types ♂ ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

The genus *Temnida* Simon was based on two species from Caracas, Venezuela. Both are described as only 3.0 mm. long. *T. simplex* a female, was selected as the genotype. The other species, *quadrivittata*, a male, differs in the size of the anterior eyes and the number of spines on the anterior tibiae, but both have the fourth pair of legs longer than the first pair, and very scant scopula on the anterior tarsi and metatarsi.

The species *Wulfila parvula* can hardly be placed in the genus *Wulfila* as the fourth pair of legs is longer than the first, a very unusual character in the *Clubionidae*. It agrees with the genotype of *Temnida* in having an uneven number of spines beneath the first tibiae, the very scant scopula on the anterior tarsi and metatarsi, and the anterior margin very little narrowed. However, the genotype has no teeth on the lower margin of the fang groove.

TEMNIDA SPINOSA spec. nov.

Figure 121

Female. Length, 3.5 mm., ceph. 1.5 mm. long, 1.0 mm. wide, abd. 2.3 mm.

Cephalothorax a bright brown, darker about the eyes, shining, with a few long colorless bristles posterior to the eyes, anterior margin very little narrowed, high, thoracic groove long; *eyes*, anterior row straight, eyes equidistant, a.m.e. smallest of the eight, separated by fully a diameter and a half, a.l.e. more than twice the diameter of a.m.e., posterior row a little longer than the anterior, procurved, eyes equidistant and subequal, p.m.e. separated by almost a diameter and a half, lateral eyes subequal; *quadrangle* much narrower in front and as high as wide behind; *clypeus* below a.m.e. a little less than a diameter of a.l.e.; *mandibles* dark brown, geniculate, with a distinct boss, two pairs of long colorless bristles near the median margin that are not long enough to cross, distal third with many bristles, fang groove oblique, lower margin with one small tooth; *labium* brown, not fused to the sternum, longer than wide with a chitinized pit each side near the base; *maxillae* brown, one and a half times as long as the labium, outer margin emarginate; *sternum* pale, convex, two-thirds as wide as long, fourth coxae separated by a diameter; *abdomen* pale, oval, convex, darker above the spinnerets, with a few short hairs, opening of the posterior spiracle about midway between the fold and the spinnerets, spinnerets closely grouped; *legs*, 4–1–2–3, pale, distal joints of the first pair darker, no scopula on anterior pairs, but a few iridescent hairs, spines, I pair, femur, dorsal, 1–1, patella, 0, tibia, ventral, 2–2–2–2–2–2 and 1 very small spine at the tip on the retrolateral row, all from a raised base, basal paired spines very long, metatarsus, ventral, 2–2, basal pair almost the length of the joint, II pair the same as the first pair, but tibia, 2–2–2–2–2 +1, a small retrolateral spine at the tip, posterior pairs pale and spines colorless, III pair, femur, dorsal, 1, patella, 0, tibia, ventral, 1, metatarsus, whorl at the tip, IV pair, femur, dorsal, 1–1–1, patella, 0, tibia, ventral, 1–1–1, metatarsus, ventral near base 2, and a distal whorl; *epigynum*, two large circular depressions, separated by about a diameter, with the lower margins chitinized, heavy dark tubes from the anterior portion of each depression unite on the median line.

Holotype ♀ Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

Temnida spinosa does not agree with the genotype in all structural characters, such as the number of teeth on the lower margin of the fang groove and the number of ventral spines on the first tibia, but there is an uneven number of spines on the anterior tibiae and all are from a raised base, and the fourth pair of legs is longer than the first.

Subfamily LIOCRANINAE

Genus PHRUROLITHUS C. Koch 1839

PHRUROLITHUS SPINOSUS spec. nov.

Figure 116

Female. Length, 2.0 mm., ceph. 0.9 mm., abd. 1.1 mm.

Cephalothorax dull brown, with radiating dark lines, darker about the eyes and a wide marginal dark stripe, more than two-thirds as wide as long, moderately convex, anterior margin much narrowed, less than half the greatest width, thoracic groove long and faint; *eyes* cover the anterior margin, anterior row procurved, a.m.e. convex, separated by less than a radius, a.l.e. slightly larger than a.m.e., and separated from them by a line, posterior row procurved, eyes equidistant, p.m.e. separated by less than a diameter, p.l.e. slightly raised and a little larger than p.m.e.; *quadrangle* higher than wide, sides parallel, a.m.e. larger than p.m.e.; *clypeus* below a.m.e. equals a diameter and a half of a.m.e.; *mandibles* dull brown, vertical, and weak, a small bristle replaces the spine usually found on the mandibles; *labium*, pale, as wide as long, tip rebordered; *maxillae* pale, twice as long as the labium, slightly inclined; *sternum* pale, convex, almost as wide as long, not continued between the fourth coxae; *abdomen* dark, sides lined, on posterior half faint chevrons can be traced, opening of posterior spiracle one-third nearer spinnerets than to fold, venter pale; *legs*, 4–1–2–3, I right missing, tarsi and metatarsi pale, other joints dark, spines, posterior pairs spineless, I pair, all spines from a raised base, long and overlapping, femur, prolateral, 3 very long spines about the middle, tibia, ventral, seven pairs, metatarsus, ventral, 4–5, II pair, femur, no prolateral spines, tibia, ventral, six pairs, metatarsus, ventral, three pairs; *epigynum*, area slightly wider than long, reddish, a broad median septum which half covers a pair of oval darkened areas each side, these separated by less than a diameter, with a small dark pit in the posterior part that probably is the opening and a small oval opening in the anterior portion of the septum.

Holotype ♀ Haiti; Étang La Chaux, 27 October 1934, (Darlington)

Phrurolithus spinosus is separated from other species of the genus found in the islands of the Caribbean, by the number of spines on the anterior tibiae and metatarsi, the three long spines on the first femur, as well as by the epigynum. The pair of bristles on the mandibles is much smaller than in the typical species, and both rows of eyes are distinctly procurved. In the European members of the genus, the sternum is prolonged between the fourth coxae.

Subfamily CORINNINAE

Genus Corinna C. Koch 1842

Corinna gracilipes (Keys.)

Hypsinotus gracilipes Keyserling, 1887, p. 448, pl. 6, fig. 3. "♀ Haiti."

Type ♀ Haiti; (Uhler)?

♂ Dom. Rep.; Puerto Plata, July–August 1941, (Hurst)

Corinna humilis (Keys.)

Hypsinotus humilis Keyserling, 1887, p. 446, pl. 6, fig. 18. "♂ ♀ St. Kitts."

3 ♀ Haiti; Port-au-Prince, (Crew), Banks Coll.

♂ Haiti; Grand Rivière, January 1913, (Mann)

Corinna parvula Bryant

Figure 120

Corinna parvula Bryant, 1940, p. 442, figs. 225, 227. "♂ ♀ Cuba; Soledad."

Male. Length, 5.0 mm., ceph. 2.1 mm., abd. 2.6 mm.

Cephalothorax chestnut-brown, roughened, cephalic portion high, anterior margin very little narrowed and little wider than the posterior margin, widest between the third pair of legs, posterior margin rebordered, thoracic groove very short, lateral striae very indistinct; *eyes* almost cover the anterior margin, anterior row very slightly procurved, a.m.e. largest of the eight, separated by a little less than a diameter and from a.l.e. by a diameter, posterior row slightly procurved, very little longer than anterior row, eyes subequal, p.m.e. separated by a diameter and a half, and from p.l.e. by more than two diameters, lateral eyes separated by a radius of p.l.e.; *quadrangle* wider than high, the same width in front as behind; *clypeus* low, about a radius of a.m.e.; *mandibles* chestnut-brown, roughened, vertical, boss small, fang groove oblique, lower margin with five small subequal teeth, fang short; *labium* not fused to the sternum, wider than long, tip rebordered, sides parallel, with a pit about midway on the lateral margins; *maxillae* more than twice as long as labium, inclined, not emarginate, palpus from the basal third; *sternum* brown, strongly convex, slightly roughened, almost as wide as long, (3.5 : 4.0), ending in an obtuse point in front of the fourth coxae, not rebordered; *pedicel* slender and long; *abdomen* elliptical, dorsum with a dark brown, smooth and shining scutum from the base to within a third of the tip, sides and tip heavily veined with dark gray, venter with a basal scutum reaching to the fold and a rectangular scutum midway between fold and spinnerets, opening of the posterior spiracle in front of the spinnerets; *legs*, 4–1–2–3, long and slender, femora darker than the other joints, spines, I pair, tibia, ventral, 1r–2–2, long and slender, no distal, metatarsus, ventral, 2–2, long and slender, scant scopula on tarsus, posterior pairs almost spineless; *palpus* as long as cephalothorax, slender, patella and tibia subequal, little longer than the diameter of the joint, tibial apophysis a thin membranous fold with parallel sides and a truncate tip, terminal joint slender, bulb semi-spherical, protruding from the cavity, few coils of tube, embolus starts midway on prolateral side of bulb and ends in a broadened tip that rests on a truncate flattened lobe with chitinized margins.

♀ Haiti; Milot, January 1913, (Mann)
♀ Haiti; Grand Rivière, January 1913, (Mann)
2 ♀ Haiti; Ennery, 7 September 1934, (Darlington)
♂ Dom. Rep.; Sanchez, July 1938, (Darlington)

CORINNA TOUSSAINTI spec. nov.

Figures 114, 123

Male. Length, 10.5 mm., ceph. 5.1 mm. long, 4.5 mm. wide, abd. 5.6 mm. long, 3.6 mm. wide.

Cephalothorax dark chestnut-brown, not granular, anterior margin very little narrower than greatest width, which is between the second pair of legs, posterior margin rebordered, about half the greatest width, cephalic portion fairly high, thoracic groove distinct, impossible to trace the radial striae; *eyes* cover little more than half the anterior margin, anterior row slightly procurved, a.m.e. largest of the eight, separated by fully a diameter, a.l.e. on low tubercles and about a diameter and a quarter of a.m.e. from a.m.e., posterior row procurved, very little longer than the anterior row, eyes subequal, p.m.e. separated by fully two diameters and from p.l.e. by three diameters, p.l.e. on low tubercles, separated from a.l.e. by a diameter; *quadrangle* wider than high, and same width in front as behind; *clypeus* less than a diameter of a.m.e. with a few very long bristles; *mandibles* dark mahogany-brown, boss distinct, swollen, with very small granules and several very long bristles, fang groove oblique, upper margin with three teeth, middle tooth largest, lower margin with four subequal teeth, fang heavy; *labium* longer than wide, tip not rebordered, not fused to the sternum, lateral margins notched one third from the base with a pit; *maxillae* about twice as long as the labium, slightly inclined, neither side emarginate, palpus from the basal third; *sternum* mahogany-brown, triangular, margins rebordered, ending in a blunt point in front of the fourth coxae; *abdomen* cylindrical, a narrow dorsal scutum three-quarters the length of the abdomen enclosing the anterior muscle spots, four pairs of long slender bristles on scutum, sides and tip veined with a dull gray, venter, with no scutum, infuscate, spinnerets closely grouped; *legs*, 4–1–2–3, paler than cephalothorax, long and slender, spines, I pair, tibia, ventral, 5p–3r, a basal prolateral spine hardly more than a bristle, none distal, no median ventral spine, metatarsus, ventral, 3p–2r, right metatarsus, ventral, 2–2, II pair, tibia, ventral, 2–2–2, metatarsus, ventral, 2–2, slight scopula on anterior tarsi, posterior pairs with few spines, irregular trichobothria on femora; *palpus* about as long as cephalothorax, femur slender with a median ventral row of 12 (?) bristles, tibia almost twice as long as patella, tibial apophysis rather short, a leaf-like process with a truncate tip, terminal joint little longer than tibia, bulb semi-spherical, protruding from the cavity, few coils of the tube in the bulb, embolus starts midway from bulb on prolateral side and ends in a broadened tip that rests against a broad piece at the tip that has chitinized margins.

Female. Length, 13.0 mm., ceph. 6.0 mm. long, 4.6 mm. wide, abd. 6.6 mm. long, 4.8 mm. wide.

Cephalothorax and *eyes* same as in the male; *mandibles* much larger and more roughened, fang groove oblique, upper margin with five teeth, fourth from the base of the fang the largest, lower margin with four teeth; *labium* same as in the male; *maxillae* wider, and not as much inclined, retrolateral margin next the scopula at the tip, with a distinct black carina, longer on the right maxilla than on the left; *sternum* the same as in the male; *abdomen* larger than in the male, with no scutum, no distinct markings; *legs*, 4–1–2–3, II and III left missing, spines, I pair, tibia, ventral, 1p, at base, 2–2–2, no distal pair, metatarsus, ventral, 2–2, II pair, tibia, ventral, 1r, at base, 2–2, metatarsus, ventral, 2–2, femora with longer ventral trichobothria than in the male; palp, femur with a median ventral row of stiff bristles; *epigynum*, a simple depression at the anterior end, followed by a transverse chitinized ridge, this is connected by a median darkened line beneath the surface that disappears above the fold. The epigynum is small for the size of the spider.

Holotype ♂ Haiti; La Visite, La Selle Range, 6,000–7,000 feet, 16–23 September 1934, (Darlington)

Allotype ♀ Haiti; La Visite, La Selle Range, 6,000–7,000 feet, 16–23 September 1934, (Darlington)

Partype ♀ pullus, Haiti; Furcy, Mt. Caibaio, 7,000 feet, 24 March 1940, (Folk)

The usual number of ventral spines on the first metatarsus in this genus is two pairs. Simon described a species from St. Vincent, *Corinna lacertosa* from both male and female, which has three pairs of spines beneath the first metatarsus, but this species has five teeth on the lower margin of the fang groove, five pairs of ventral spines on the first tibia, and no mention is made of a dorsal scutum on the abdomen of the male. It is possible that the first left leg of the male has been renewed and the number of spines is not normal.

Genus LAUSUS Simon 1898

LAUSUS PULCHELLUS spec. nov.

Figure 122

Female. Length, 7.0 mm., ceph. 2.5 mm. long, 2.0 mm. wide, abd. 4.0 mm. long, 2.3 mm. wide.

Cephalothorax a bright brown, shaded with gray on the sides, darker about the eyes, strongly convex, anterior margin not much narrowed and about the same width as the posterior, margins rebordered, thoracic groove very long; *eyes* vary little in size, cover about two-thirds the anterior margin, anterior row recurved, a.m.e. dark, smallest of the eight, separated by a diameter, a.l.e. about one-third larger than a.m.e. and separated from a.m.e. by a radius of a.l.e., posterior row slightly recurved, little longer than the anterior row, eyes subequal, p.m.e. separated by at least three diameters and from p.l.e. by more than a diameter, lateral eyes separated by more than a diameter; *quadrangle* narrower in front and not as high as wide behind; *clypeus* below a.m.e. about a radius of a.m.e.; *mandibles* brown with very few bristles, vertical, boss large, fang groove oblique and long, upper margin with no teeth, lower margin with five teeth, the two near the base of the fang subequal and followed by a space, then three teeth opposite the tip of the fang, the middle tooth the largest, fang long; *labium* one and a half times as long as wide, lateral margins on basal third notched, tip about as wide as base; *maxillae* one and a half times as long as labium, inner margins parallel, basal half very broad, distal half much narrowed; *sternum* pale brown, triangular, four-fifths as wide as long, convex, margins rebordered, and with a chitinized point opposite each coxa; *abdomen* gray, covered with small white iridescent scales and longer dark hairs, no markings, venter paler; *legs,* 4–2–1–3, slender, rather short, coxae pale, long, other joints brown, first pair, femur flattened laterally, spines dorsal, 1 spine near base, ventral, 0, lateral, 0, patella, 0, tibia, dorsal, 0, ventral, 1–1, prolateral, 1–1, retrolateral, 0, metatarsus, dorsal, 0, ventral, 1, prolateral, 1, all spines long and very slender, II pair, femur, dorsal, 1 near base, patella, 0, tibia, ventral, 1–1–1, lateral, 0, metatarsus, ventral, 1, lateral, 0, posterior pairs with dorsal, lateral and ventral spines on tibiae and metatarsi, a dorsal basal spine on fourth tibia; *epigynum,* area as wide as long, two clear areas widely separated, more than their diameter above the fold that may be the openings, posterior margins of the areas heavily chitinized and a chitinized edge at right angles carried almost to the fold, anterior, are two large sacs beneath the surface that almost touch on the middle margin with a small median chitinized lobe at the anterior portion of the area above a circular opening.

Holotype ♀ Dom. Rep.; rain forest, north of Valle Nuevo, Cordillera Central, 6,000 feet+, August 1938, (Darlington)

Paratype ♀ Dom. Rep.; rain forest, north of Valle Nuevo, Cordillera Central, 6,000 feet+, August 1938, (Darlington)

The genus *Lausus* was based by Simon on two species from the Amazon. The genotype, *Lausus aeneus* (Simon), originally placed in the genus *Corinna,* is described as slightly smaller than *Lausus pulchellus,* has the lateral eyes more widely separated than the median, and has five teeth on the lower margin of the fang groove; the spines on the anterior tibiae are described as few and weak, and the abdomen is shining.

Genus TRACHELAS L. Koch 1866

TRACHELAS BICOLOR Keys.

Trachelas bicolor Keyserling, 1887, p. 440, pl. 6, fig. 15. "♀ Haiti." Bryant, 1940, p. 443, figs. 224, 233, 235. "♂ Cuba; Santiago de las Vegas."

♂ ♀ pullus Dom. Rep.; Cordillera Central, Loma Rucilla Mountains, 5,000–8,000 feet, June 1938, (Darlington)

APPENDIX

Other Spiders Reported From Hispaniola

For the sake of completeness, all other spiders reported from Hispaniola are given below in a systematic list. An asterisk (*) before the name indicates the island as the type locality. In every case the author and the year of the description has been added. A second name and date is a reference to the person reporting the species from Hispaniola. In some cases, at least, the correct determination is impossible, and other species will prove to be errors of determination.

Family BARYCHILIDAE

*TRICHOPELMA NITIUM Simon, 1888

Family THERAPHOSIDAE

*CYRTOPHOLIS CURSOR (Ausserer), 1875
*PAMPHOBETEUS NIGRICOLOR (Ausserer), 1875
*SCOPELOBATES SERICEUS Simon, 1903

Family PISAURIDAE

THAUMASIA MARGINELLA (C. Koch), 1848; Banks 1903

Family THERIDIIDAE

ARGYRODES TRITUBERCULATUS Becker, 1879; Banks, 1903

Family ARGIOPIDAE

ERIOPHORA BALAUSTINA (McCook), 1888; Banks, 1903, pullus
ARANEA BISPINOSA (Keyserling), 1884; McCook, 1893
*ARANEA PERPLEXA (Walckenaer), 1842
WAGNERIANA UNDECIMTUBERCULATA (Keyserling), 1865; Petrunkevitch 1911
CYRTOPHORA SERRATA Simon, 1895
GASTERACANTHA HILARIS Thorell, 1859; Banks, 1903
GASTERACANTHA SEXSERRATA (Walckenaer), 1837
*MICRATHENA FLAVOMACULATA Keyserling, 1863

Family CTENIDAE

*CTENUS HAITIENSIS Strand, 1910

Family CLUBIONIDAE

EUTICHURUS INSULANUS Banks, 1902; Banks, 1903

Family SALTICIDAE

*ICIUS SEPARATUS Banks, 1903
PARNAEUS CHRYSIS (Walckenaer), 1837; Peckham, 1909

BIBLIOGRAPHY

BANKS, NATHAN

1896. New North American Spiders and Mites. Trans. Amer. Ent. Soc., **23**, pp. 57–77.

1900. Some New North American Spiders. Canad. Entomol., **32**, pp. 96–102.

1901. Some Spiders and other Arachnida from Porto Rico. Proc. U. S. Nat. Mus., **24**, pp. 217–227, pl. 15.

1903. A List of Arachnida from Hayti, with Descriptions of New Species. Proc. Acad. Nat. Sci. Phila., **55**, pp. 340–345, pl. 15.

1908. New Species of Theridiidae. Canad. Entomol., **41**, pp. 205–208.

BECKER, LÉON

1879. Diagnoses de nouvelles Aranéides américaines. Ann. Soc. Ent. Belgique, **22**, pp. 77–86, pls. 1–2.

BLAUVELT, HELEN H.

1937. The Comparative Morphology of the Secondary Sexual Organs of Linyphia and Some Related Genera, Including a Revision of the Group. Festschr. Strands, **2**, pp. 81–171, pls. 6–23.

BRYANT, ELIZABETH B.

1936. Descriptions of Some New Species of Cuban Spiders. Mem. Soc. Cubana Hist. Nat., 5th ser., **10**, pp. 325–332, pl. 23.

1940. Cuban Spiders in the Museum of Comparative Zoölogy. Bull. Mus. Comp. Zoöl., Harvard, **86**, pp. 249–542, pls. 1–22.

1942a. Notes on the Spiders of the Virgin Islands. Ibid., **89**, pp. 317–363, pls. 1–3.

1942b. Three Species of Coleosoma from Florida. Psyche, **51**, pp. 51–58, 1 pl.

CAMBRIDGE, O. PICKARD-

1880. On some new and little known Spiders of the Genus Argyrodes. Proc. Zool. Soc. London, pp. 320–342, pls. 28–30.

1882. On new Genera and Species of Araneidea. Ibid., pp. 424–442, pls. 29–31.

CHAMBERLIN, RALPH V.

1925. New North American Spiders. Proc. Calif. Acad. Sci., 4th ser., **14**, pp. 105–142, figs.

1929. On Three New Spiders of the Genus Oxyopes. (Araneina). Entomol. News, **40**, pp. 17–20.

EMERTON, J. H.

1875. Notes on Spiders from Caves in Kentucky, Virginia and Indiana. Amer. Nat., **9**, pp. 278–281, pl. 1.

Fabricius, J. C.

1792–1794. Entomologia Systematica, etc. 4 vols. Aranea, 1793, 2, pp. 407–428.

Gertsch, W. J.

1946. Notes on American Spiders of the Family Dictynidae. Amer. Mus. Nov., no. 1319, pp. 1–21, including 3 pls.

Hentz, Nicholas Marcellus

1842. Descriptions and Figures of the Araneides of the United States. Journ. Boston Soc. Nat. Hist., **4**, pp. 223–237, pl. 8.
1845. (continuation), **5**, pp. 189–202, pls. 16, 17.
1847. (continuation), **5**, pp. 444–478, pls. 23, 24, 30, 31.
1850. (continuation), **6**, pp. 18–35, pls. 3, 4; ibid., pp. 271–293, pls. 9, 10.
1875. The Spiders of the United States. Occ. Pap. Boston Soc. Nat. Hist., **2**, pp. xii, 171, pls. 1–21.

Keyserling, Graf Eugen von

1876. Ueber amerikanische Spinnenarten der Unterordnung Citigradae. Verh. zool. bot. Ges. Wien, **26**, pp. 609–708, pls. 7, 8.
1880–1886. Die Spinnen Amerikas. In 4 vols. published at Nürnberg, vol. 1, 1880, Laterigradae, pp. 1–283, pls. 1–8.
1884–1886. Theridiidae, Vol. 2. in 2 parts, pp. 1–222, pl. 1–10, and pp. 1–295, pls. 11–21.
1881. Neue Spinnen aus Amerika. Verh. zool. bot. Ges. Wien, **31**, pp. 269–314, pl. 11.
1887. Neue Spinnen aus Amerika. Ibid., **37**, pp. 421–490, pl. 6.

Koch, C. L.

1841. Die Arachniden, etc., **8**, pp. 1–131, pls. 253–288.

Koch, L.

1866–1867. Die Arachniden Familie der Drassiden. Nürnberg, pp. 1–352, pls. 1–14.

Latreille, P. A.

1806–1809. Genera Crustaceorum et Insectorum. Paris, (Araneides, **1**, pp. 82–127).

Linnaeus, C.

1767. Systema Naturae, etc. 12th ed., vol. 1, Aranea, pp. 1030–1037.

Lucas, H.

1845. Sur une nouvelle espèce d'Aranéide appartenant au genre Scytodes de M. Walckenaer. Ann. Soc. Ent. France, 2nd ser., **3**, pp. 67–73, pl. 1, fig. 2.

MacLeay, W. S.

1839. On some new Forms of Arachnida. Ann. Mag. Nat. Hist., 1st ser., **2**, pp. 1–14, pls. 1, 2.

Marx, George

1890. Catalogue of the described Araneae of Temperate North America. Proc. U. S. Nat. Mus., **12**, pp. 497–594.

Olivier, G. A.

1789. Araignée, Aranea. Encycl. Méth. Hist. nat. Ins., Paris, **4**, pp. 173–240.

Petrunkevitch, Alexander

1929–1930. The Spiders of Porto Rico. Trans. Conn. Acad. Arts Sci., part 1, **30**, pp. 1–158, 150 figs.; part 2, **30**, pp. 159–355, 240 figs.; part 3, 1930, **31**, pp. 1–191, 168 figs.

Pocock, R. I.

1901. Some new and old genera of the South American Aviculariidae. Ann. Mag. Nat. Hist., 7th ser., **8**, pp. 540–555.

1903. On some Genera and Species of South American Aviculariidae. Ibid., **11**, pp. 81–115.

Simon, Eugène

1891–1897. On the Spiders of the Island of St. Vincent. Part 1, Proc. Zool. Soc. London, pp. 549–575, pl. 42; part 2, 1894, pp. 519–526, 4 figs.; part 3, 1897, pp. 860–890.

1897. Descriptions d'espèces nouvelles de l'ordre des Araneae. Ann. Soc. Ent. France, **65**, pp. 465–510, pls. 12, 13.

Taczanowski, L.

1873. Les Aranéides de la Guyane française. Horae Soc. Ent. Ross., **10**, pp. 56–117, pl. 2.

Walckenaer, C. A.

1837–1842. Histoire Naturelle des Insectes Aptères. Paris, 1837, **1**, pp. 1–682; 1842, **2**, pp. 1–549.

INDEX OF GENERA AND SPECIES[1]

aeneus, Lausus 438
agilis, Cyrtopholis 334, 337
agilis, Odo 405
Alauximus 345
albomaculatus, Chrysso 382
Alopecosa 353
americana, Uloborus 393
Anelosimus 381
anglicana, Ceratinopsis 388
annecta, Thaumasia **349**
antiguensis, Olios 414
antillana, Dysderina 339
antillana, Eperigone **388**
antoni, Theridion 383
Anyphaena 421, 428
Anyphaenella 425
Aranea 440
Arctosa 352
Argyrodes 379, 440
Ariadna 339
Artema 366
arthuri, Ariadna 340
atlanta, Artema 366
atlantica, Lycosa 356
audanti, Oecobius **344**
Auximus 348
avidus, Ctenus **397**
Aysha 429

balaustina, Eriophora 440
banksi, Thymoella **378**
bella, Frontinella **386**
bellulus, Misumenops 420
benneri, Oecobius 345
bicolor, Trachelas 439
bispinosa, Anyphaena 422
bispinosa, Aranea 440
blandum, Coleosoma 373
Blechroscelis 366

calcarata, Grammonota **390**
cancerides, Phormictopus 334, 337
Caponina 342
Caridrassus 406
caudata, Conopistha 379
celer, Misumena 420
cellulanus, Nesticus 385
Ceraticelus 387
Ceratinopsis 388
Chiracanthium 420
chrysis, Parnaeus 440
Chrysso 382
cinerea, Arctosa 353
Clubiona 420
coccinea, Frontinella 387
coccineus, Nops 344
Coleosoma 373
communicans, Hamataliwa 358
communis, Frontinella 387
connexus, Tinus 350
Conopistha 379
Corinna 434
cornuta, Umfila 374
Craspedisia 373
crassipes, Thymoites 378
crassus, Alauximus **346**
crewi, Oxyopes **361**
Ctenus 397, 402, 440
cubana, Hamataliwa 358
Cupiennius 402
cursor, Cyrtopholis 334, 439
Cyrtopholis 334
Cyrtophora 440

darlingtoni, Caponina **342**
darlingtoni, Ctenus **398**
darlingtoni, Lomaita **392**
Deinopis 394
dentichelis, Auximus 349
dentimandibulata, Erigone 389
Dictyna 372
differens, Theridion 383

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[1] Synonyms are in italics, and new species are in bold face.

Dipoena 376
Drymus 363
Dysderina 340

Emmenophrys 357
Eperigone 388
Episinus 382
eremita, Nesticus 385
Erigone 389
Eriophora 440
Eutichurus 440

fabrilis, Lycosa 353
fascicula, Anyphaenella **425**
femoratus, Modisimus **367**
ferox, Aysha 429
festina, Lycosa **354**
Filistata 339
flavidus, Spintharus 380
flavomaculata, Micrathena 440
floridana, Coleosoma 373
fragilis, Anyphaenella **427**
fraternus, Anelosimus **381**
Frontinella 386
fuesslyi, Theridion 382
fulva, Psalistops **335**
fusca, Scytodes 365
fuscus, Modisimus **368**

Gasteracantha 440
geniculatus, Uloborus 394
geometricus, Latrodectus 377
Gephyrina 419
glaucus, Modisimus 369
globimanus, Oonops 342
globosus, Physcyclus 372
gracilipes, Anyphaenella 428
gracilipes, Corinna 434
Grammonota 390
granulatus, Onoculus 418
gratiosus, Episinus 382
gratus, Auximus **348**
grisea, Hamataliwa 358
grossa, Teutana 376
guanica, Dictyna 372

haitiensis, Ctenus 398, 440
Hamataliwa 357–360
haytiana, Hamataliwa 358
hebraica, Scytodes 365
Heteropoda 414
hibernalis, Filistata 339
hiemalis, Ctenus **399**
hilaris, Gasteracantha 440
hispaniola, Mimetus **395**
hortorum, Leucauge 394
humilis, Corinna 434
hursti, Odo **403**
Hypsinotus 434

Icius 440
inclusum, Chiracanthium 420
inconspicua, Lycosa **355**
inconspicua, Poecilochroa **408**
infumatus, Alauximus **347**
insulanus, Ctenus **400**
insulanus, Eutichurus 440
insularis, Selenops 414
insularis, Teminius 409
interfector, Mimetus 397
interruptum, Theridion 373
Isaloides 416

lacertosa, Corinna 437
lamia, Deinopis 394
latens, Miagrammopes 393
Latrodectus 377
latus, Ogulnius **394**
Lausus 437
lauta, Anyphaena **421**
Leucauge 394
Linyphia 387
Lithyphantes 375
Lomaita 391
longipes, Scytodes 365
Lycosa 354–356

mactans, Latrodectus 377
maculatus, Nesticus **384**
maculosa, Psalistops **336**
magnus, Caridrassus **406**
manni, Ctenus **401**
marginella, Thaumasis 350, 439

Miagrammopes 393
Micrathena 440
Mimetus 395
minuta, Poecilochroa 408
Misumena 420
Misumenops 420
modesta, Anyphaena **422**
modesta, Teutana **375**
Modisimus 367
monticolus, Ctenus **401**
monticolus, Teminius **411**
morosa, Dipoena **376**
multispinosa, Ariadna **339**
mutchleri, Epicatus 418

nephilae, Conopistha 380
Nesticus 384
nigra, Sphecozone 391
nigricolor, Pamphobeteus 334, 439
nigrinus, Tinus 352
nigritarsus, Hamataliwa **360**
nitium, Trichopelma 334, 439
Nops 344

obtectus, Ogulnius 395
obtusa, Conopistha 380
Odo 403
Oecobius 344
Ogulnius 394
Olios 414
Onocolus 416
Oonops 341
oophorus, Lithyphantes 373
opulenta, Theridula 383
Oxyopeidon 357, 358
Oxyopes 361

pallidus, Nesticus 385
Pamphobeteus 334, 439
Pardosa 356
Parnaeus 440
parvula, Corinna 434
parvula, Temnida 430
perplexa, Aranea 440
Peucetia 363
Phormictopus 334, 339
Phrurolithus 433
Physocyclus 372
Poecilochroa 408
poeyi, Erigone 389
portoricensis, Oreonetides 390
porto-ricensis, Pardosa 356
productus, Auximus 349
Psalistops, 335
pulchellus, Lausus **437**
punctata, Gephyrina **419**
pusilla, Anyphaena **423**

quadrivittata, Temnida 431

radiatus, Selenops 415
ravida, Aysha 430
reducta, Lycosa 356
remota, Anyphaena **424**
rugosa, Stephanopsis 416

saetosa, Stasina **413**
sallei, Cupiennius 402
salticus, Oxyopes 361
Scopelobates 334
Scytodes 365
Selenops 414
separatus, Icius 440
septemmaculata, Lithyphantes 375
sericeus, Scopelobates 334, 439
serrata, Cyrtophora 440
serripes, Blechroscelis 366
sexoculatus, Modisimus 370
sexserrata, Gasteracantha 440
simoni, Drymusa **363**
simplex, Temnida 431
solitaris, Ariadna 340
solitarius, Ceraticelus **387**
spatulata, Craspedisia **373**
spinipes, Trujillina **405**
spinosa, Temnida **432**
spinosus, Phrurolithus **433**
Spintharus 380
Stasina 413
stenaspis, Triaeris 342

Stephanopsis 416
studiosum, Anelosimus 382
Syrisca 411

tantilla, Arctosa **352**
Teminius 409
Temnida 430
tenuis, Aysha 430
testacea, Caponina 343
Teutana 375
texanus, Oecobius 345
Thaumasia 349
Theridion 382
Theridula 383
Thymoella 377
Thymoites 378
Tinus 350
toussainti, Corinna **435**
toussainti, Isaloides 416
Trachelas 439
Triaeris 342
Trichopelma 334
tricuspis, Anyphaena 425
trifidus, Selenops **415**
trituberculatus, Argyrodes 440
Trujillina 405
tuberculata, Oxyopeidon 361

Uloborus 393
undecimtuberculata, Wagneriana 440

validus, Oonops **341**
velox, Aysha 430
venatoria, Heteropoda 414
venustus, Onocolus **416**
viridans, Peucetia 363
vittatus, Modisimus **370**

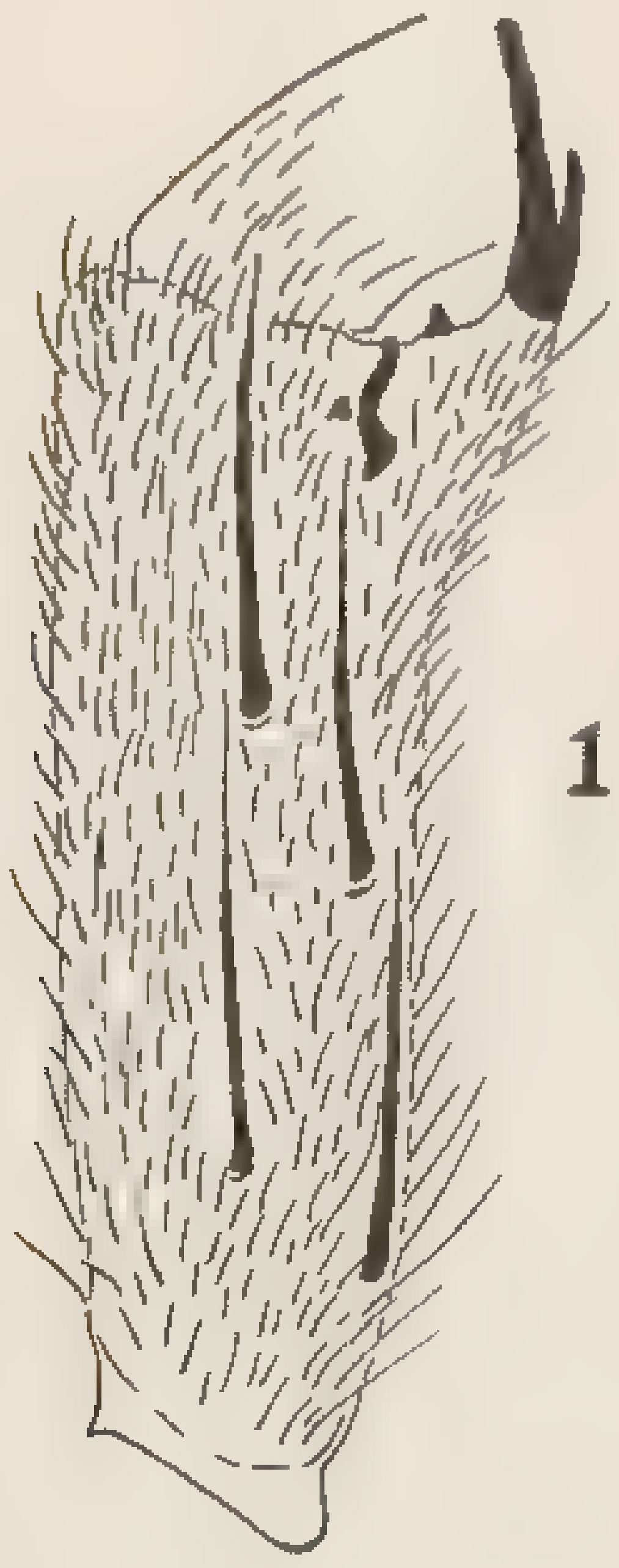
Wagneriana 440
wheeleri, Caridrassus 407
Wulfila 430

PLATES

PLATE 1

PLATE 1

Fig. 1. *Psalistops maculata* spec. nov., left I tibia.
Fig. 2. *Psalistops fulva* spec. nov., left I tibia.
Fig. 3. *Oonops validus* spec. nov., left palpus, prolateral.
Fig. 4. *Oecobius audanti* spec. nov., epigynum.
Fig. 5. *Psalistops fulva* spec. nov., left palpus.
Fig. 6. *Cyrtopholis agilis* Pocock, left I tibia.
Fig. 7. *Cyrtopholis agilis* Pocock, left palpus.
Fig. 8. *Psalistops maculata* spec. nov., left palpus.
Fig. 9. *Psalistops fulva* spec. nov., left palpus.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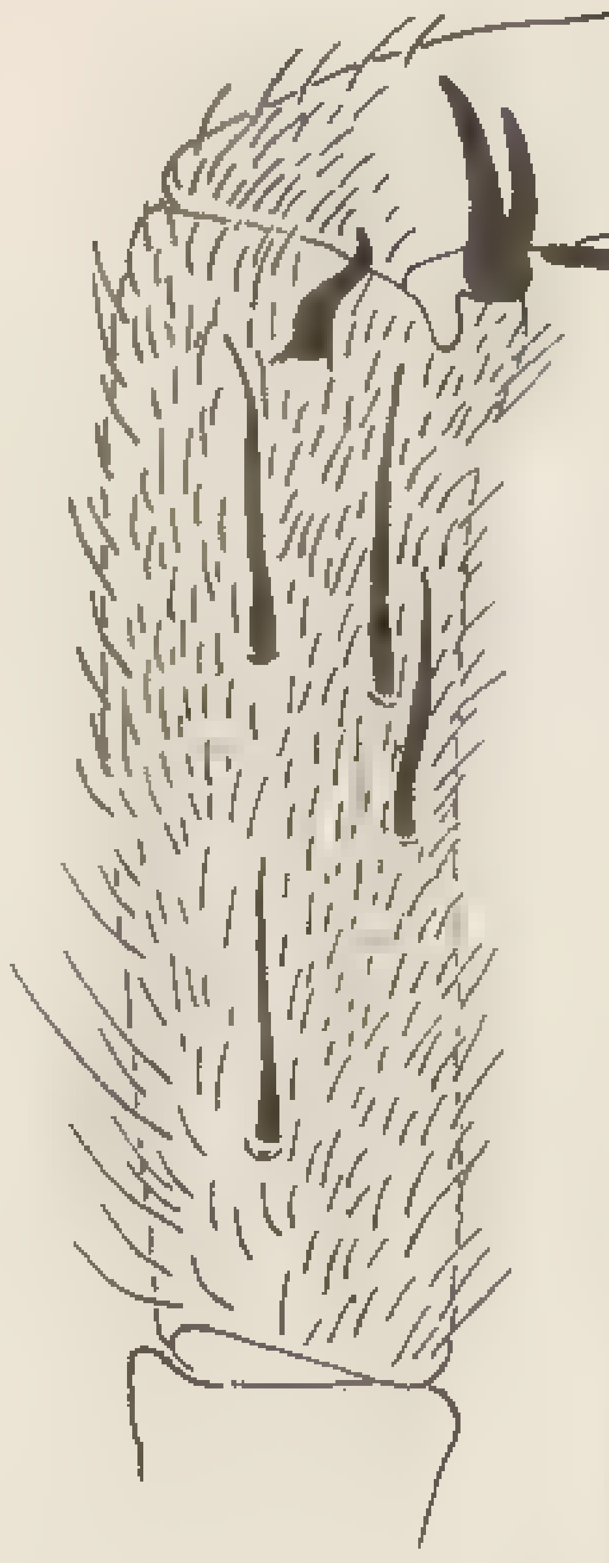
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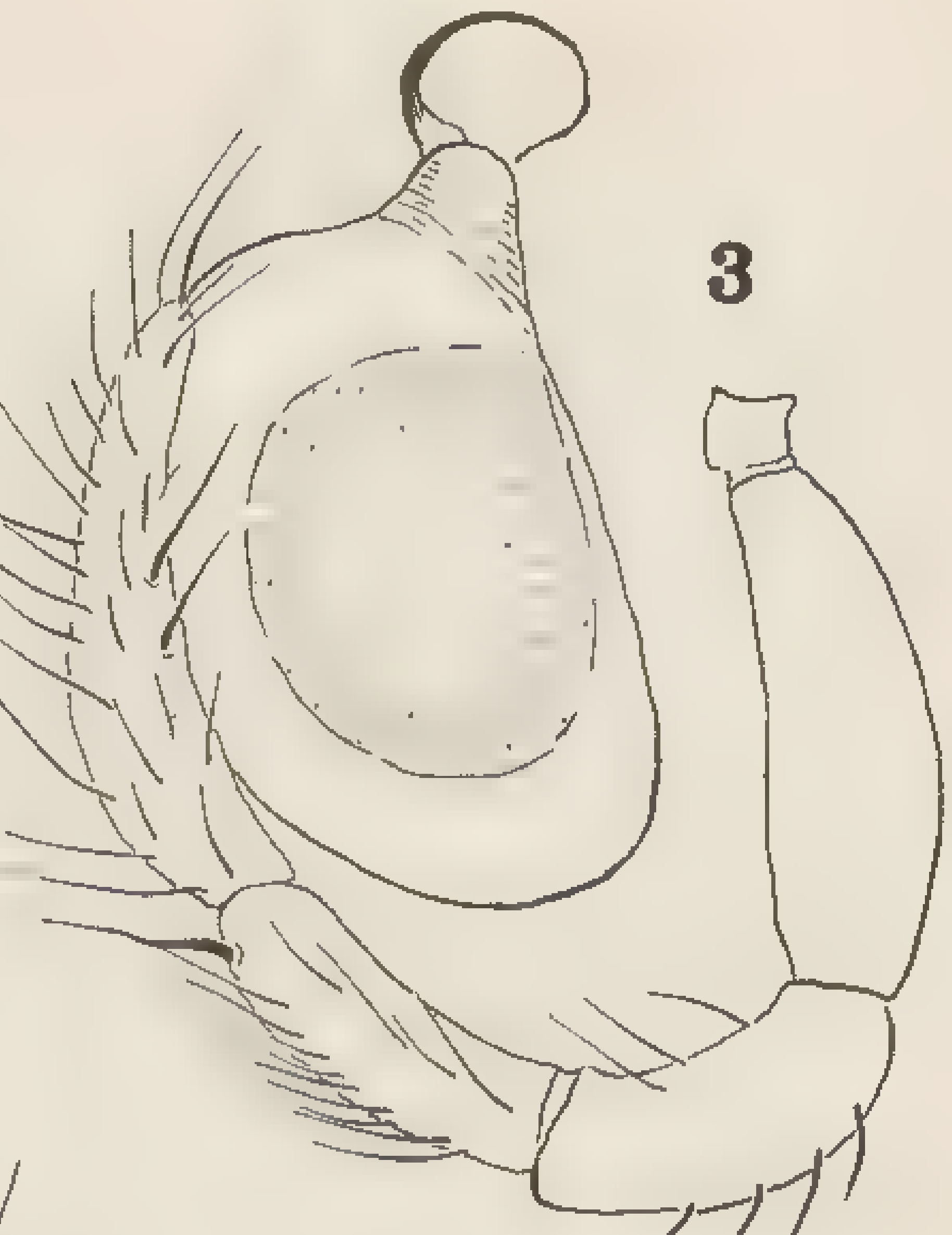
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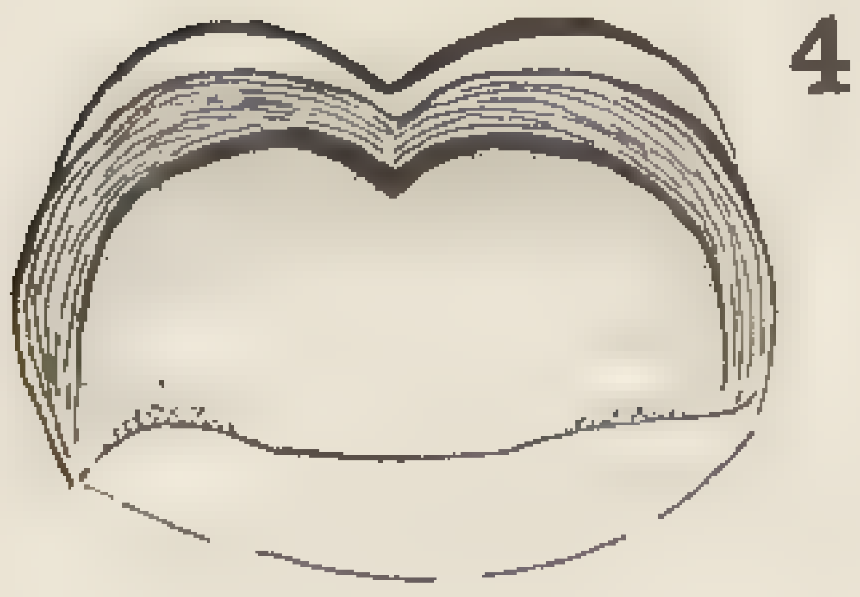
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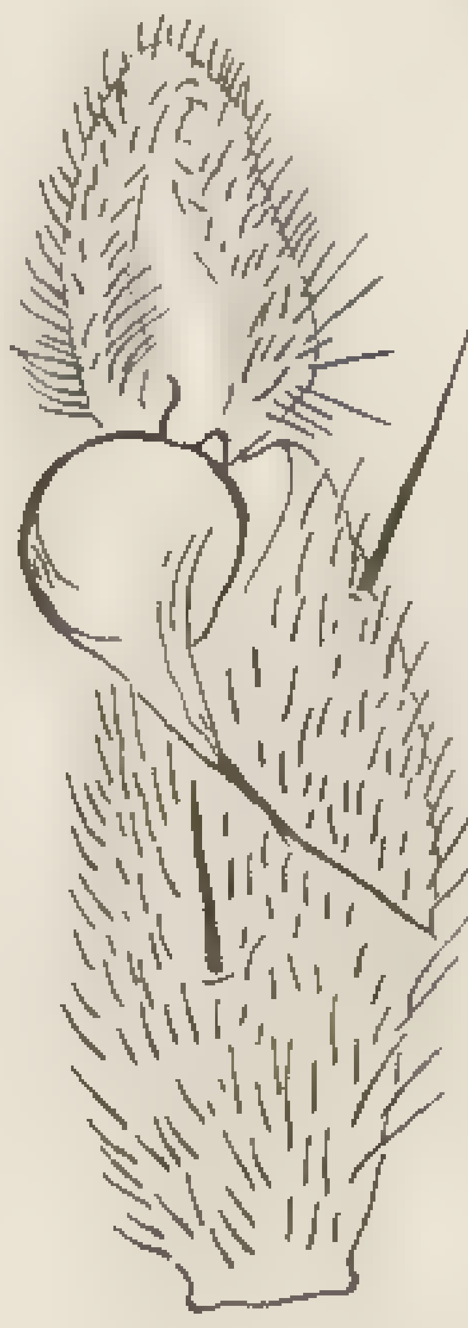
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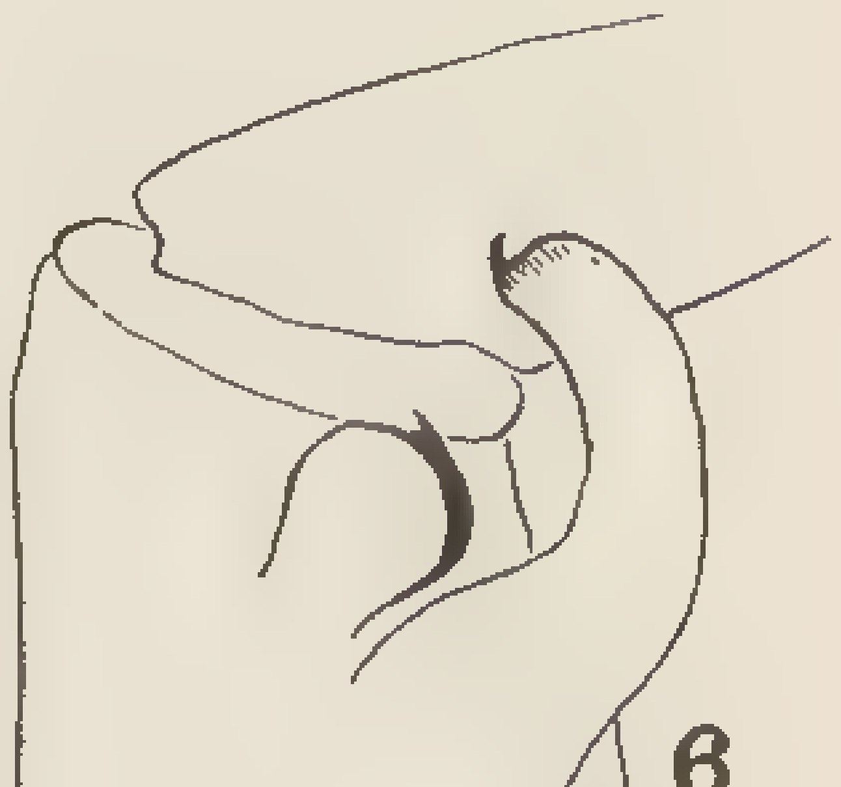
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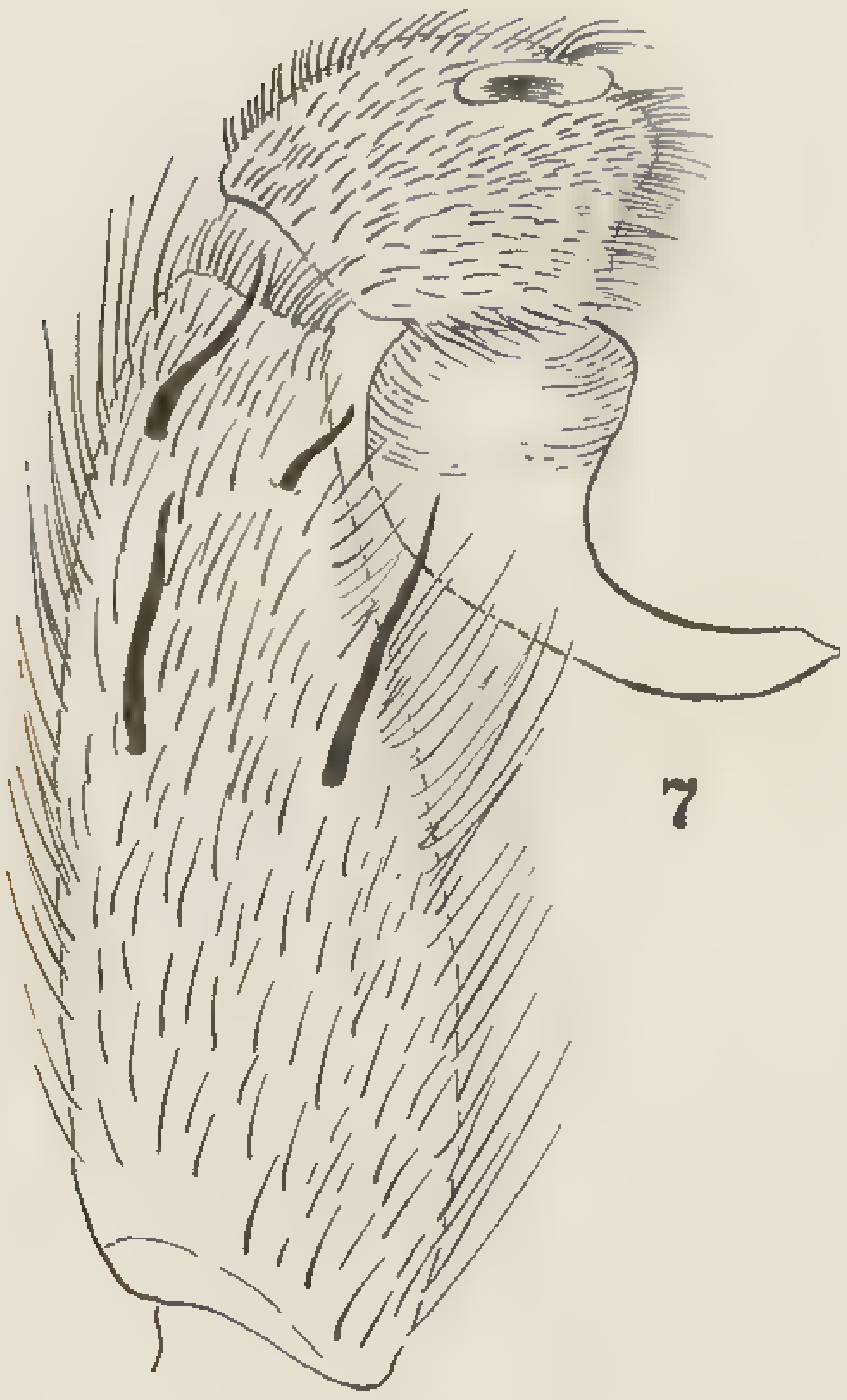
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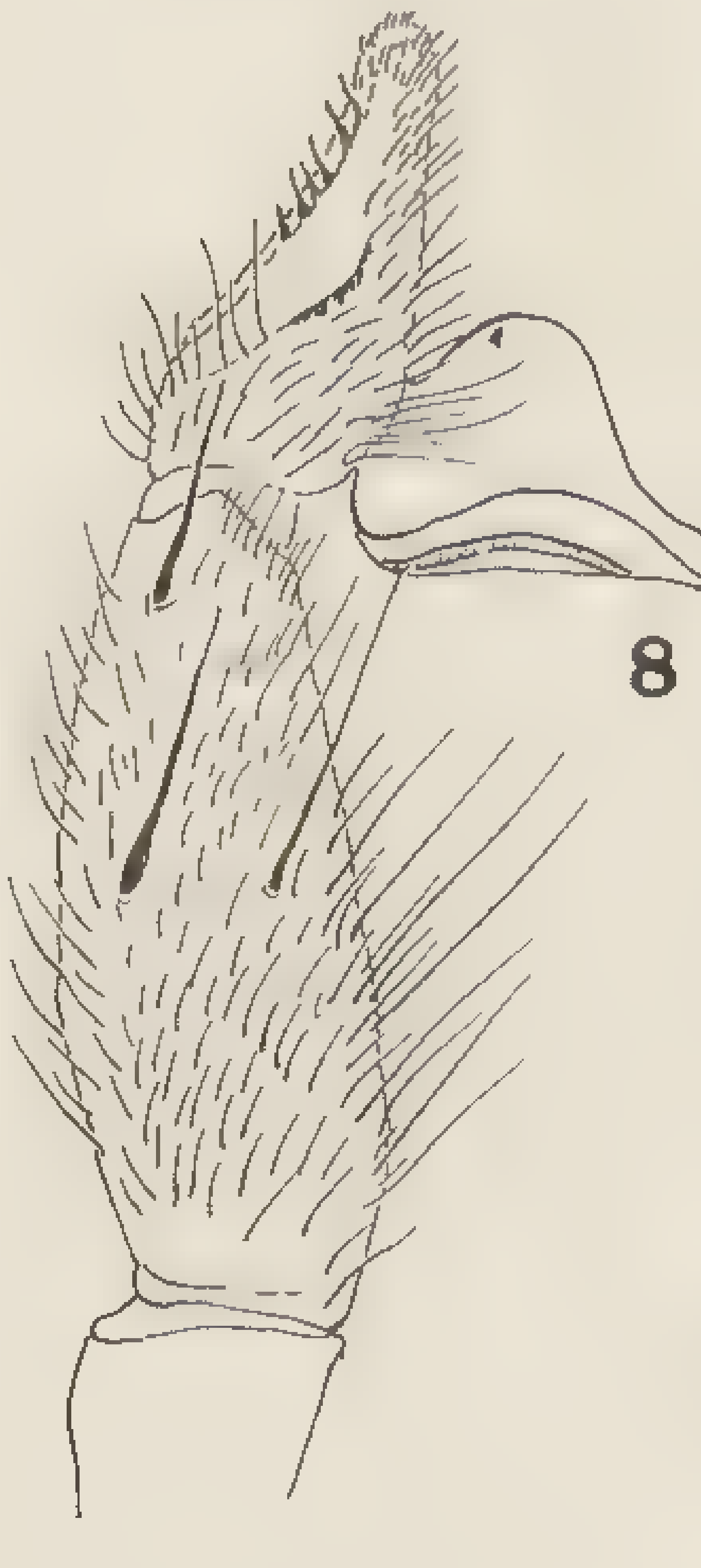
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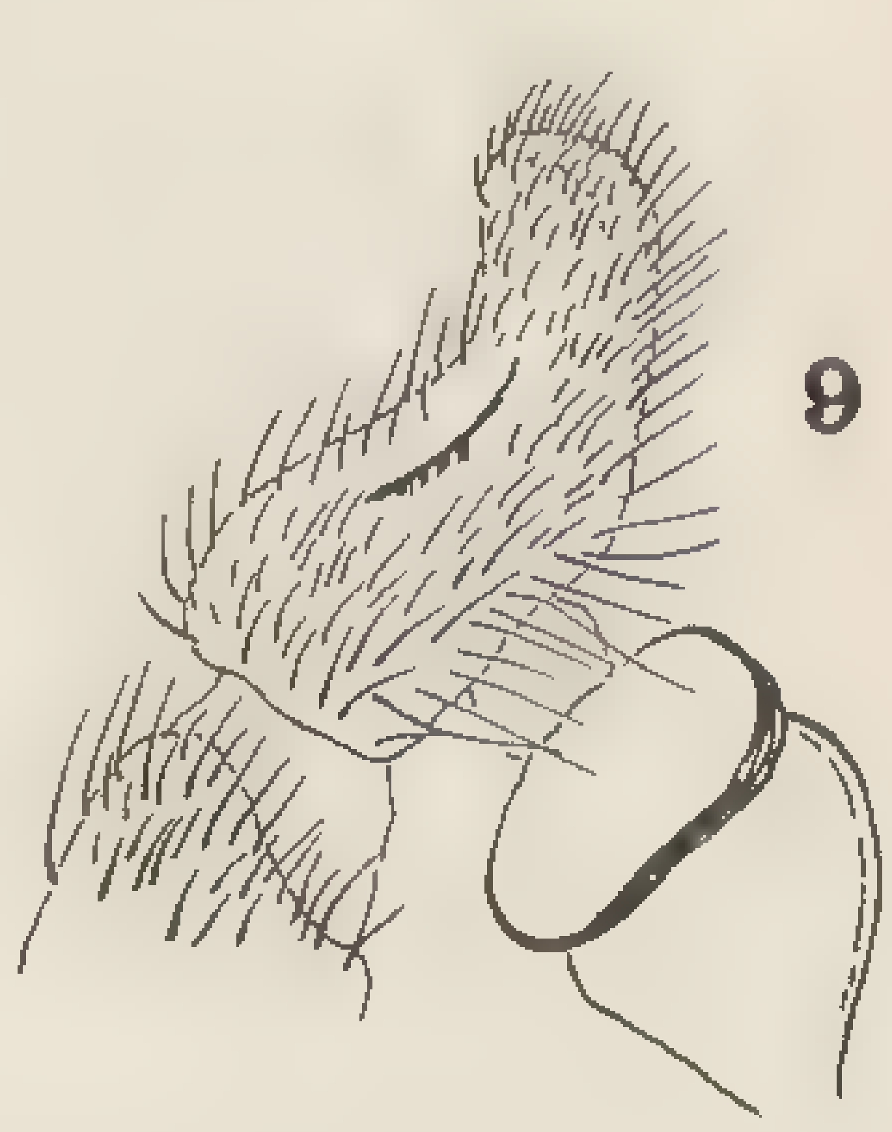
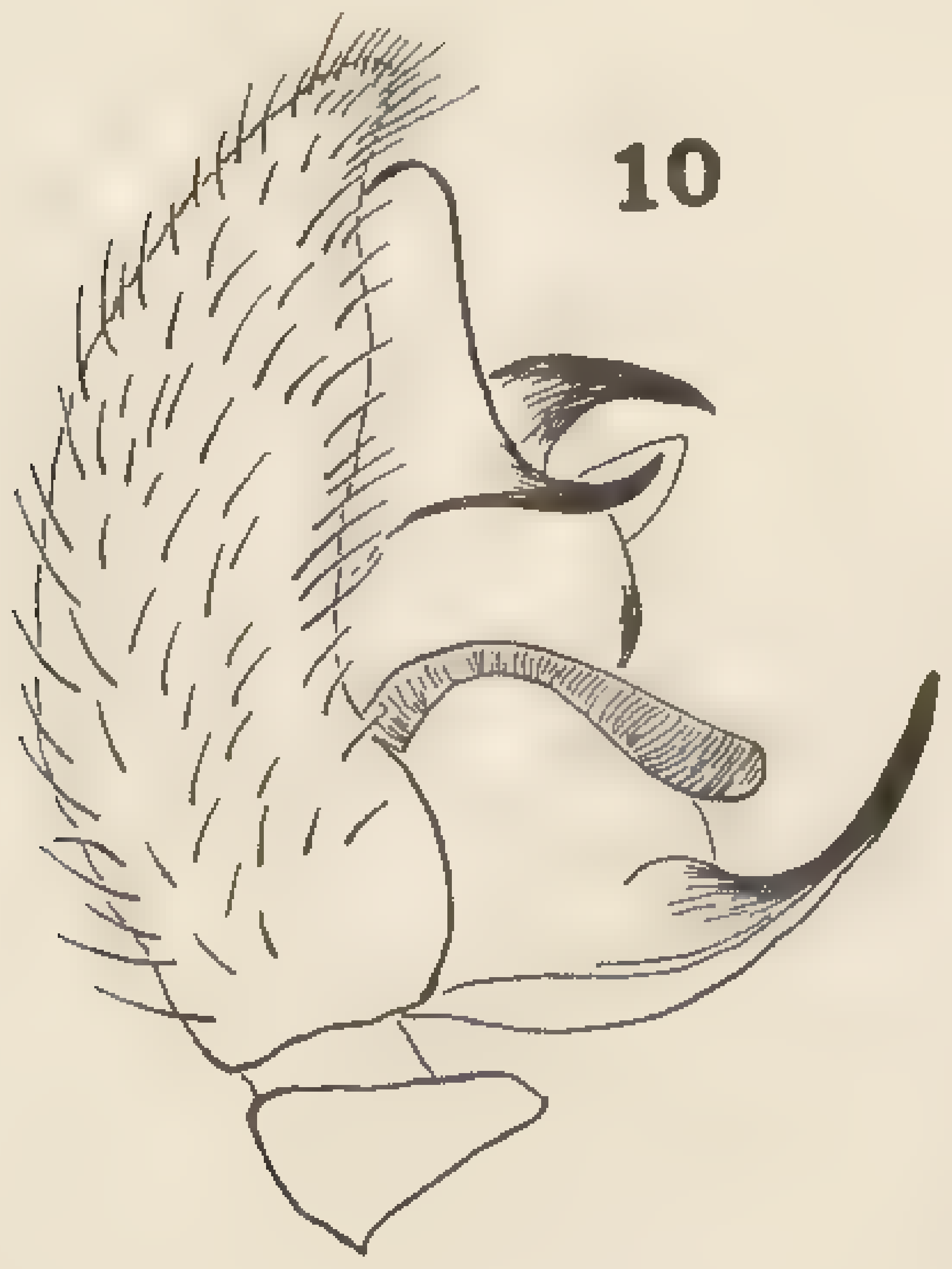

9

PLATE 2

PLATE 2

Fig. 10. *Oecobius audanti* spec. nov., left palpus, prolateral.
Fig. 11. *Lycosa festina* spec. nov., left palpus.
Fig. 12. *Oecobius audanti* spec. nov., left palpus, retrolateral.
Fig. 13. *Alauximus crassus* spec. nov., epigynum.
Fig. 14. *Alauximus infumatus* spec. nov., epigynum.
Fig. 15. *Auximus gratus* spec. nov., epigynum.
Fig. 16. *Lycosa inconspicua* spec. nov., epigynum.
Fig. 17. *Tinus connectus* (Bryant), left palpus.
Fig. 18. *Thaumasia annecta* spec. nov., epigynum.
Fig. 19. *Tinis connectus* (Bryant), left palpus, tibia and patella.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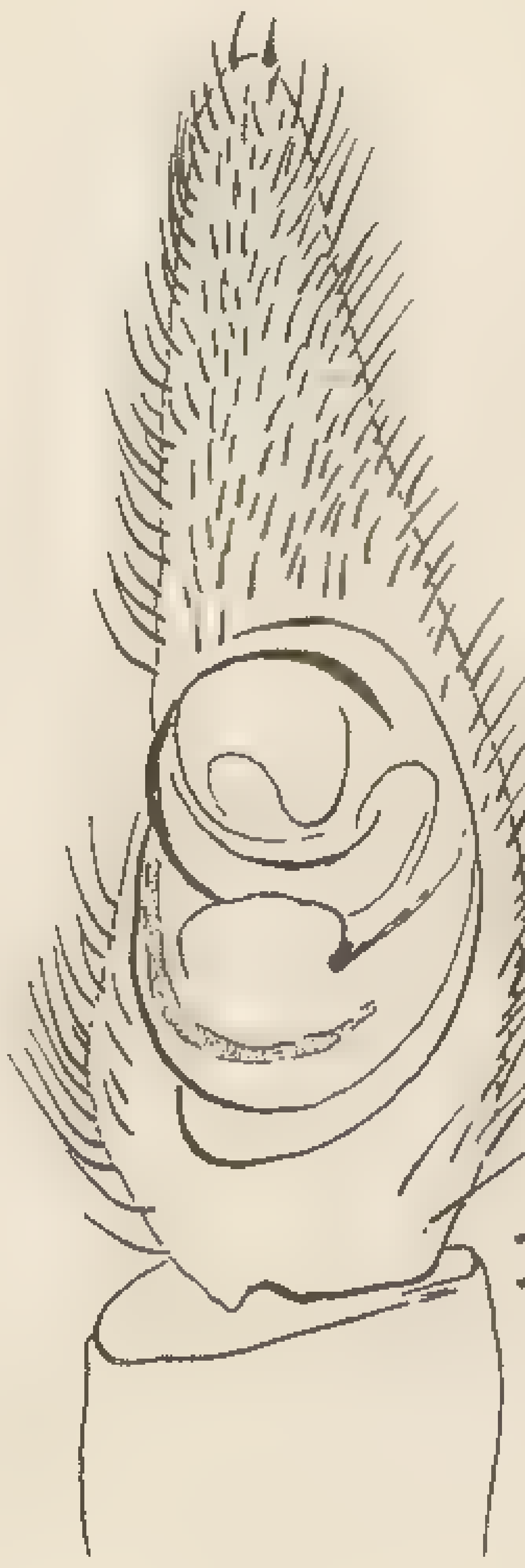
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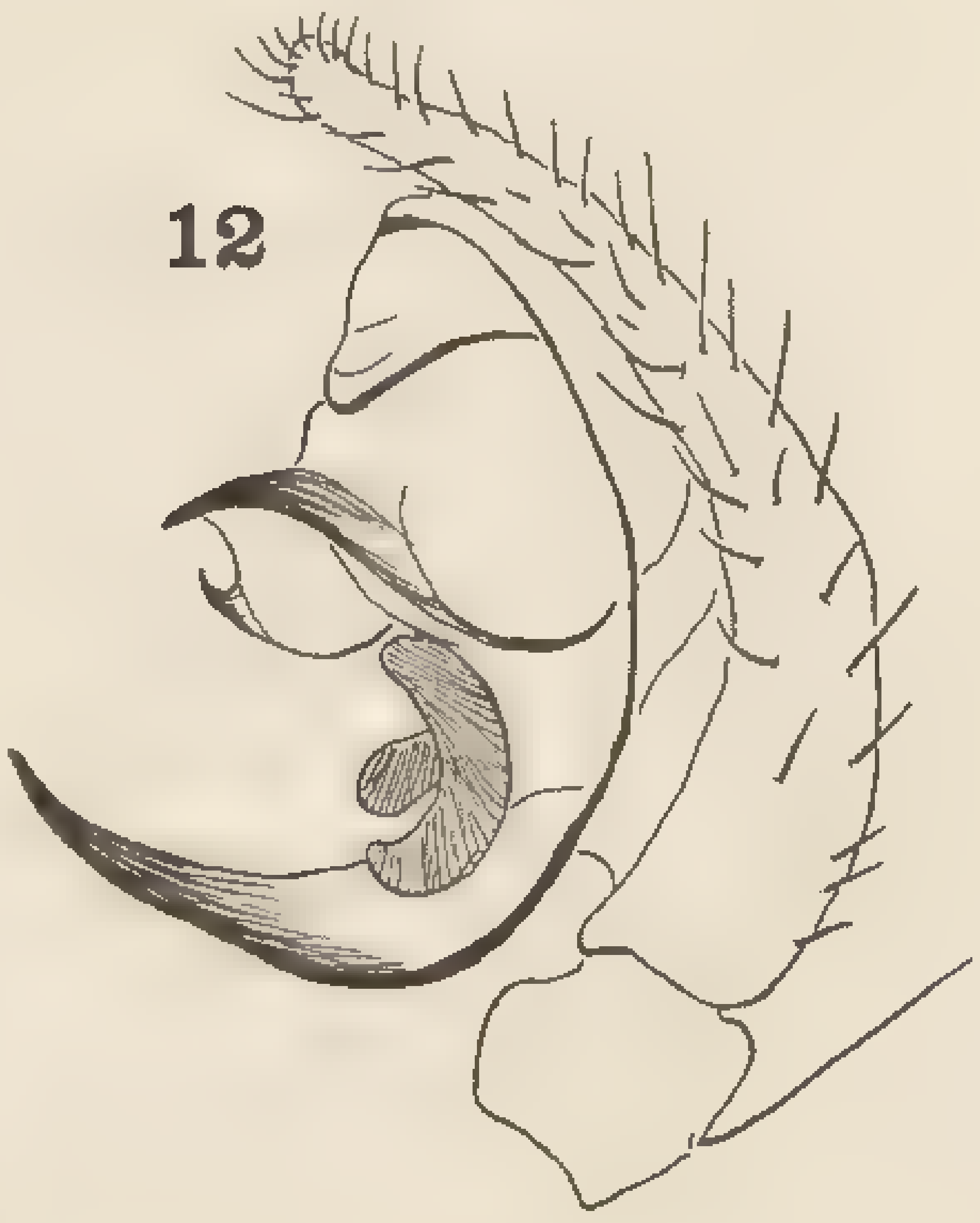
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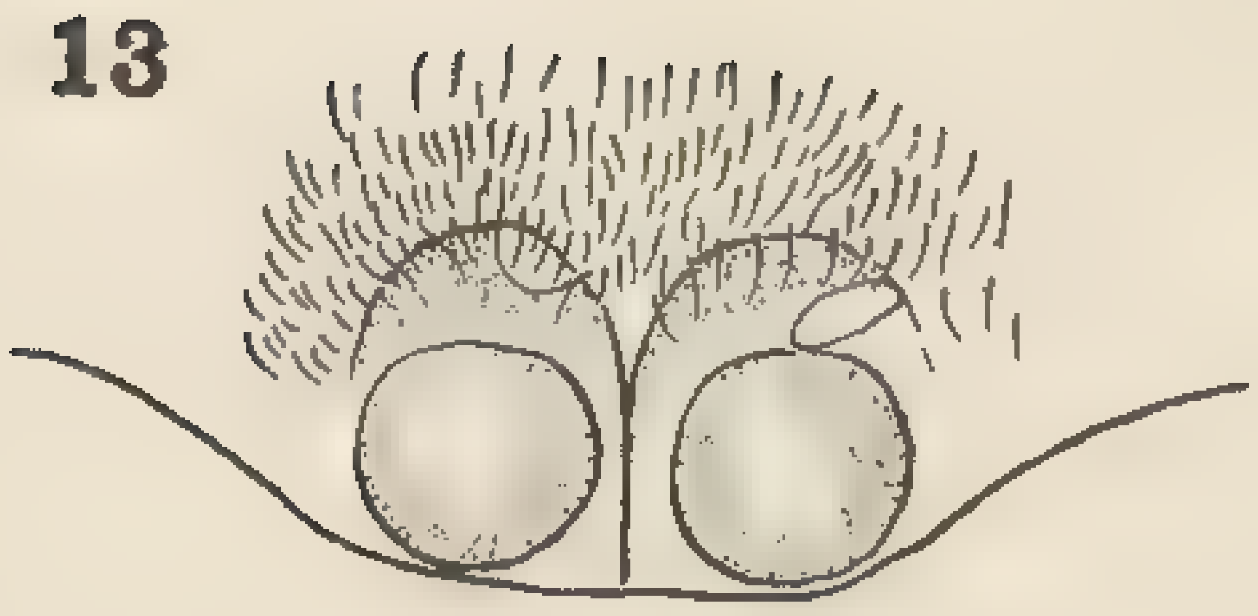
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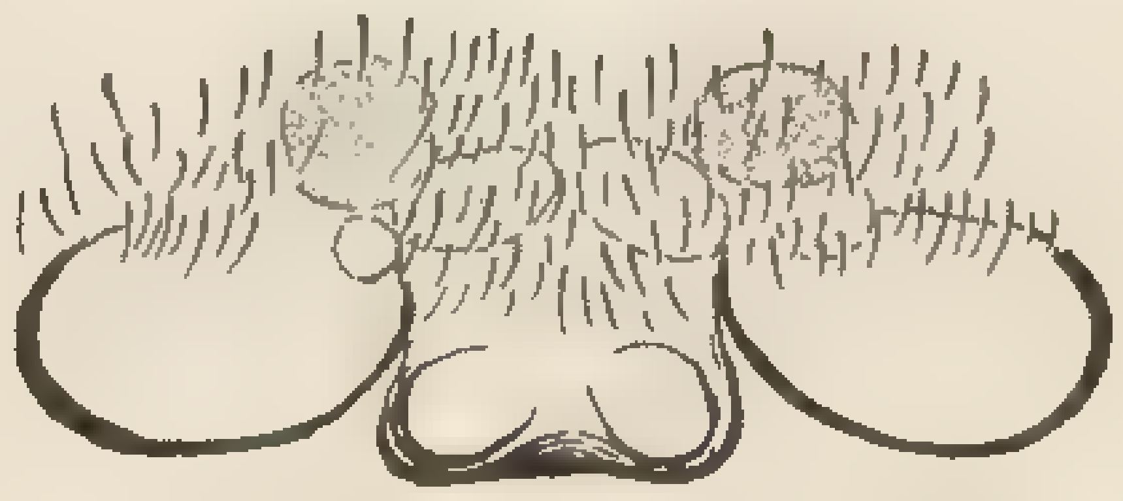
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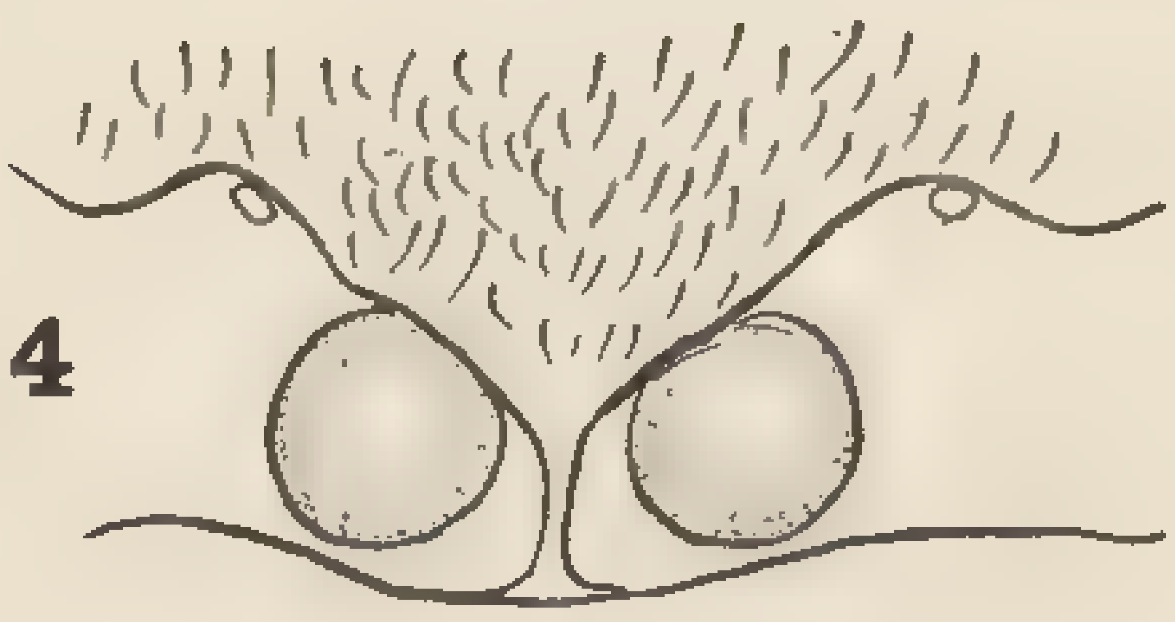
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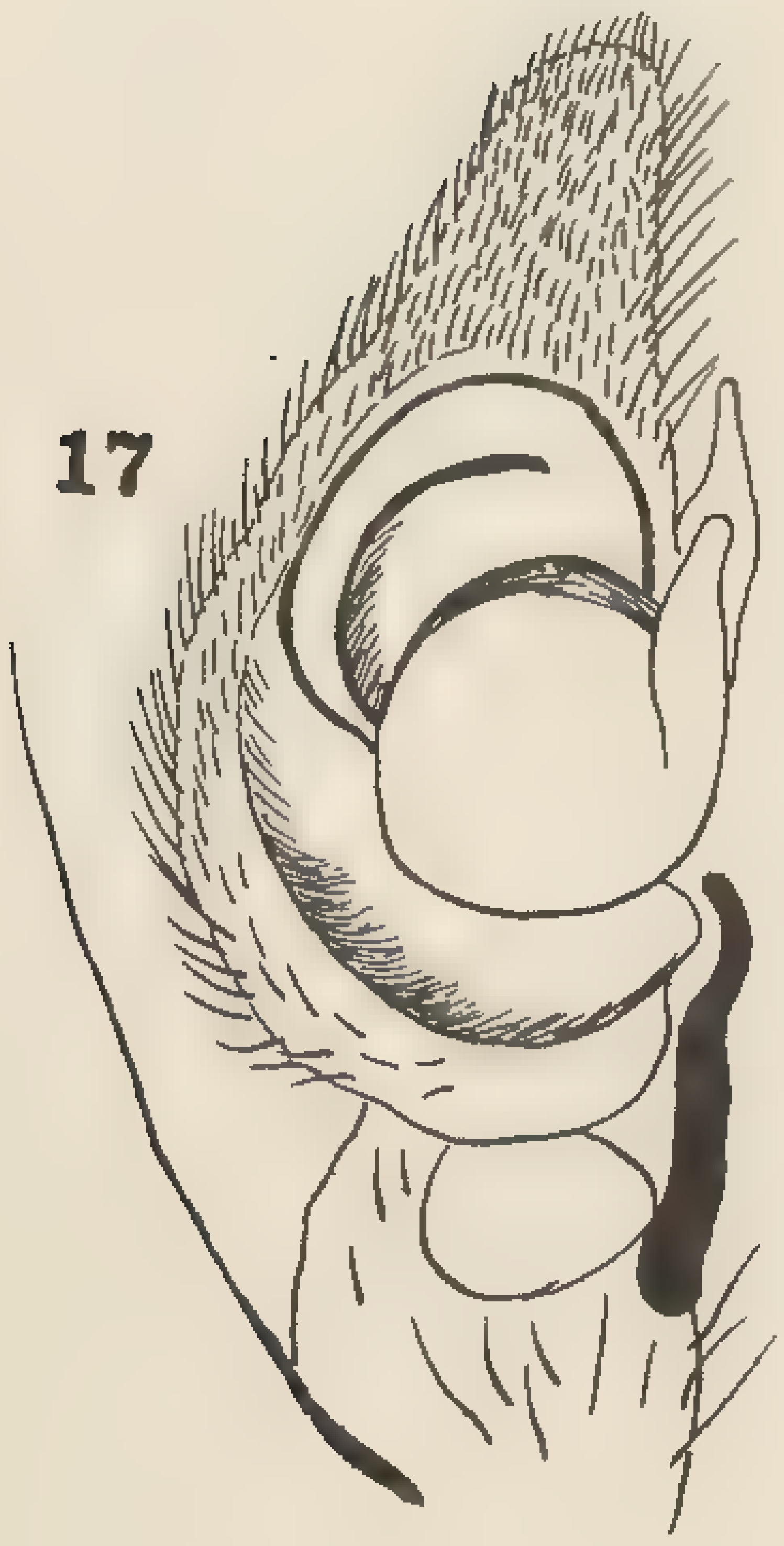
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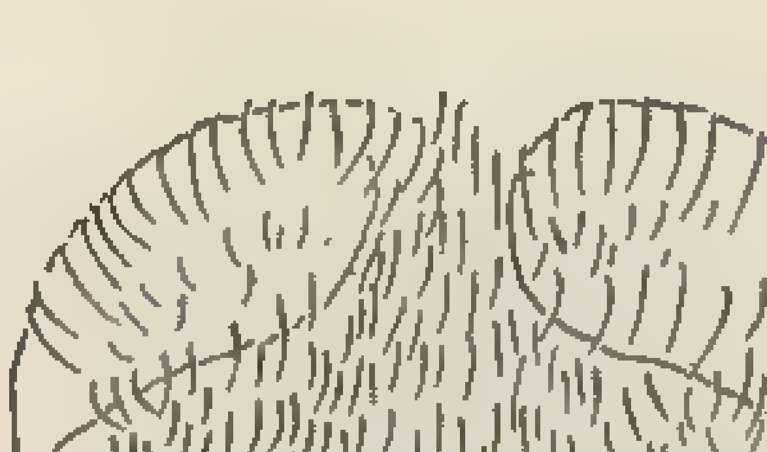
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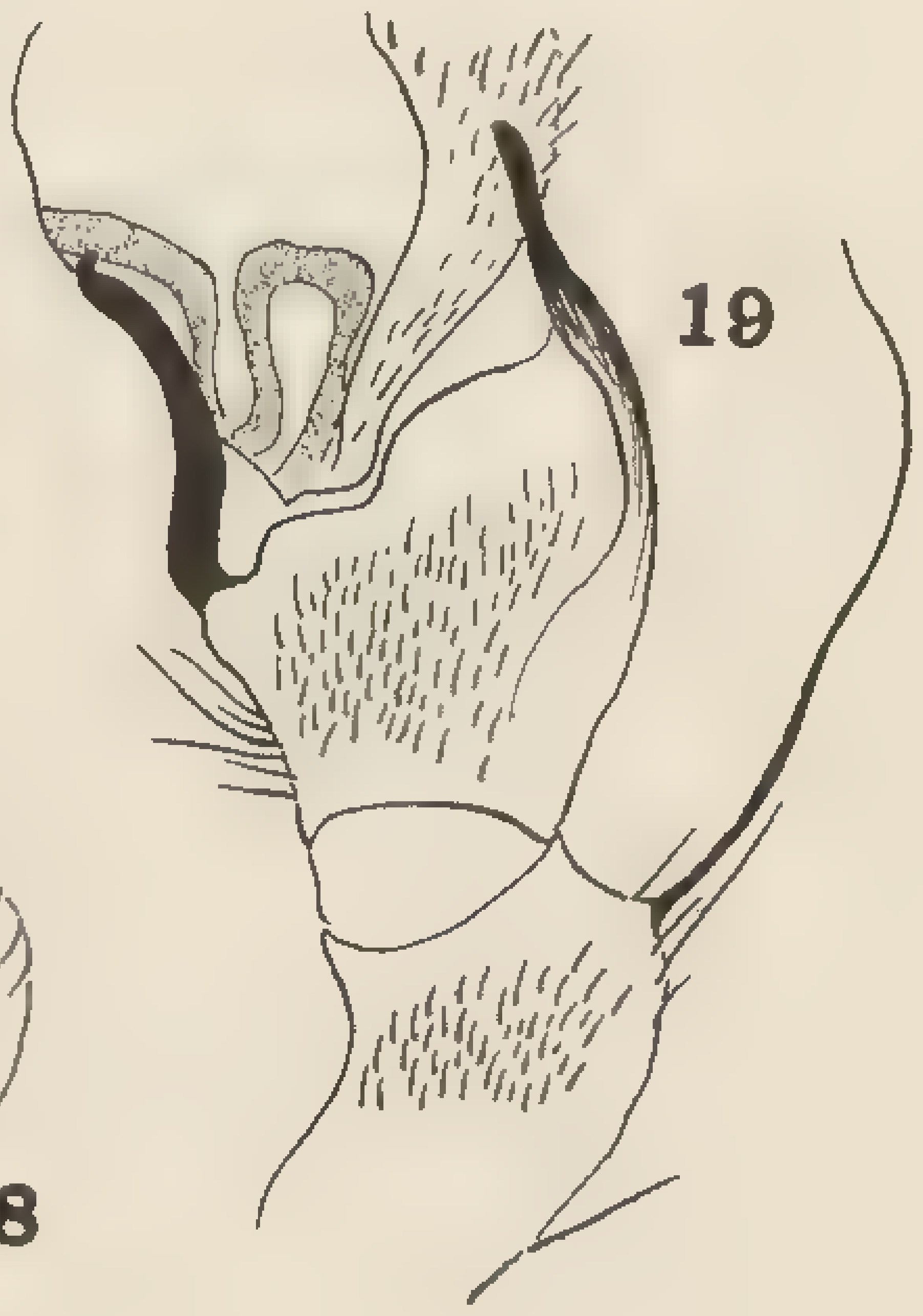

19

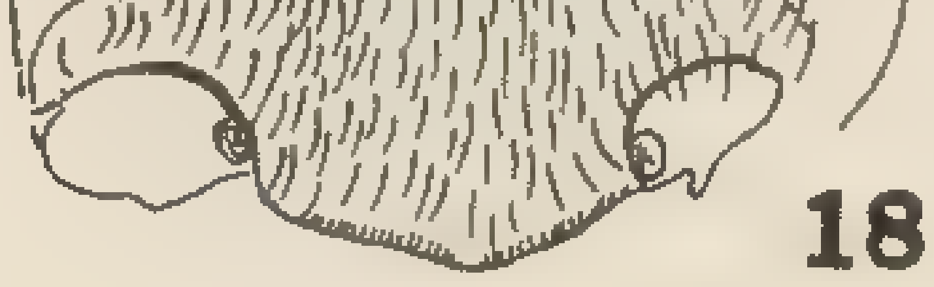
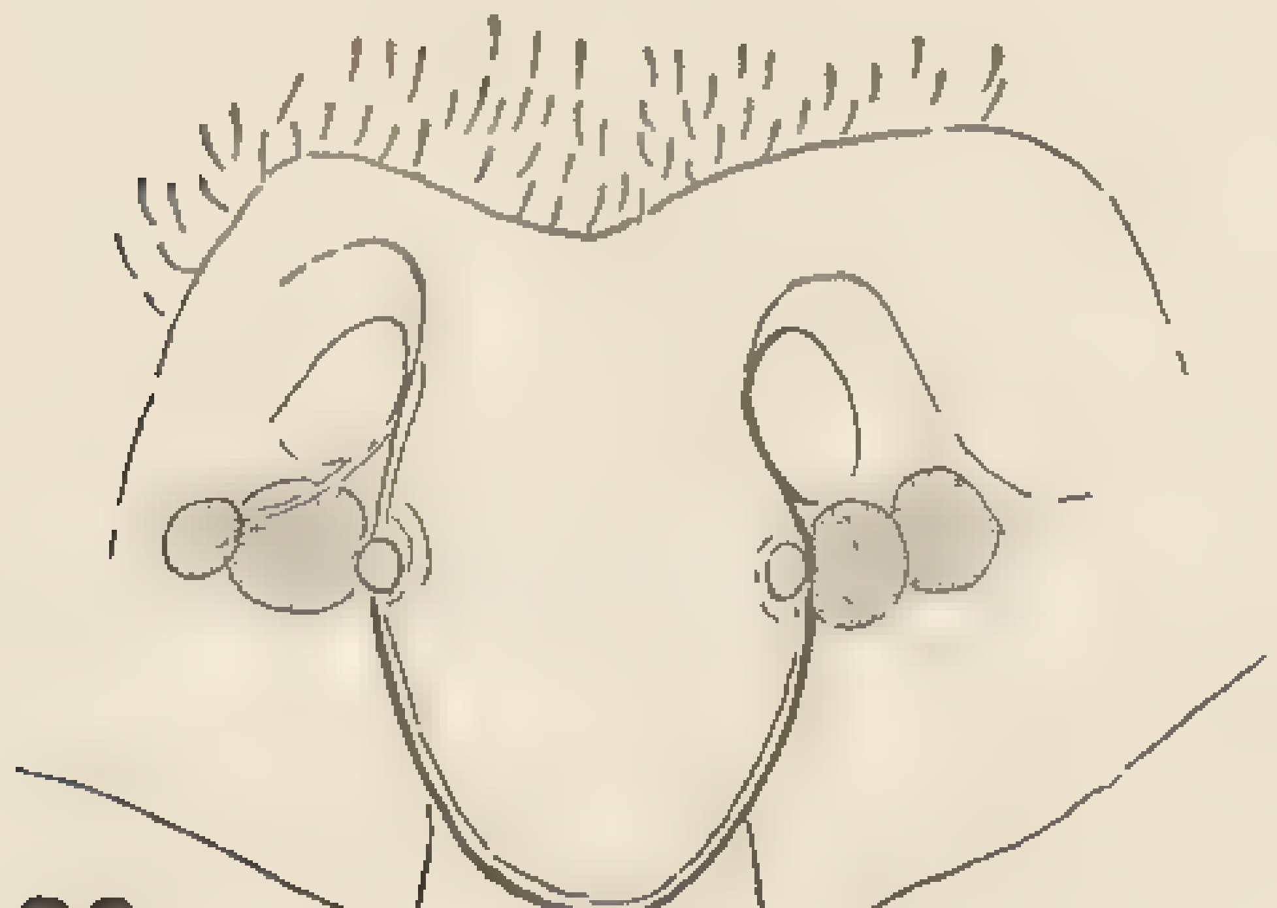

18

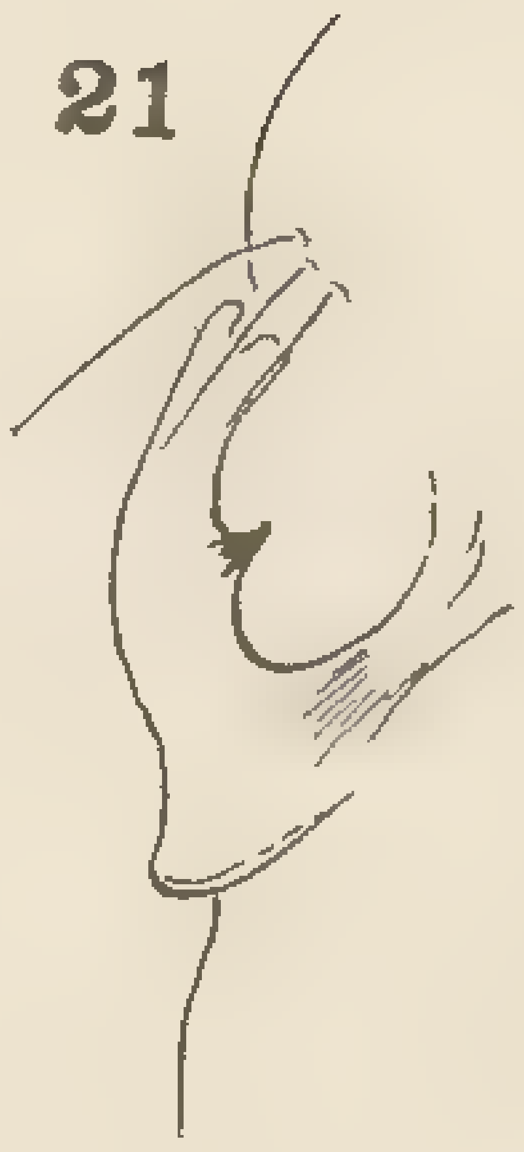
PLATE 3

PLATE 3

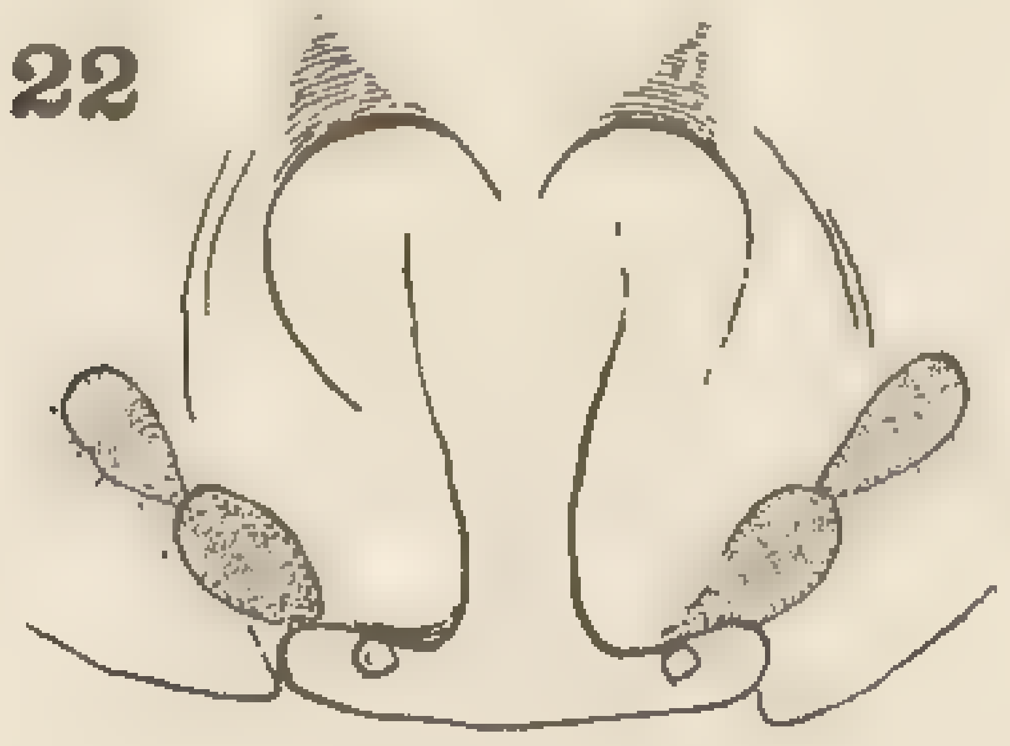
Fig. 20. *Arctosa tantilla* spec. nov., epigynum.
Fig. 21. *Oxyopes crewi* spec. nov., epigynum, lateral.
Fig. 22. *Lycosa festina* spec. nov., epigynum.
Fig. 23. *Hamataliwa haytiana* (Chamb.), left palpus, ventral.
Fig. 24. *Hamataliwa haytiana* (Chamb.), left palpus, prolateral.
Fig. 25. *Drymusa simoni* spec. nov., left palpus, lateral.
Fig. 26. *Oxyopes crewi* spec. nov., epigynum.
Fig. 27. *Oxyopes crewi* spec. nov., left palpus.
Fig. 28. *Hamataliwa nigritarsus* spec. nov., epigynum.
Fig. 29. *Hamataliwa nigritarsus* spec. nov., left palpus, prolateral.



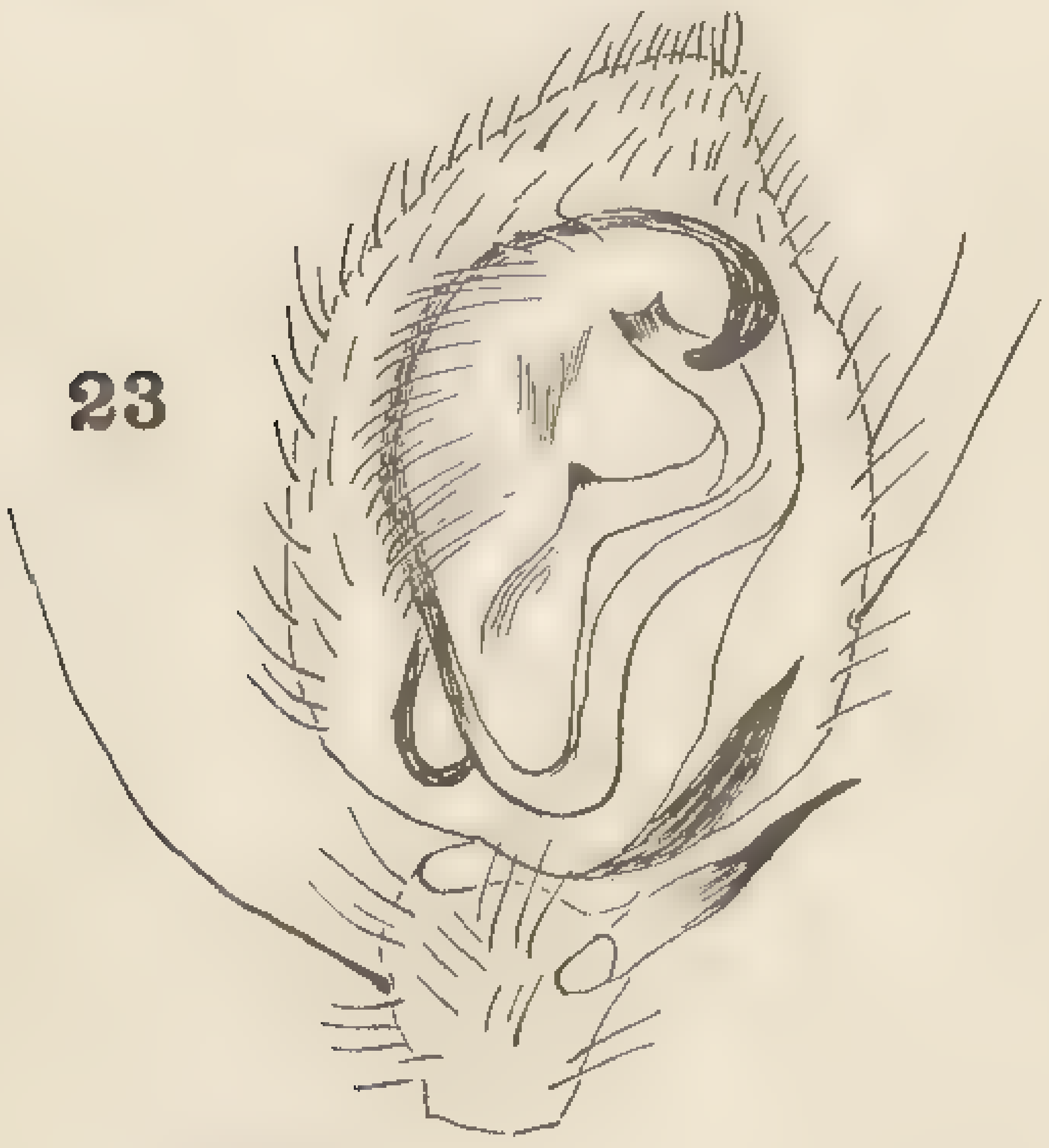
20



21



22



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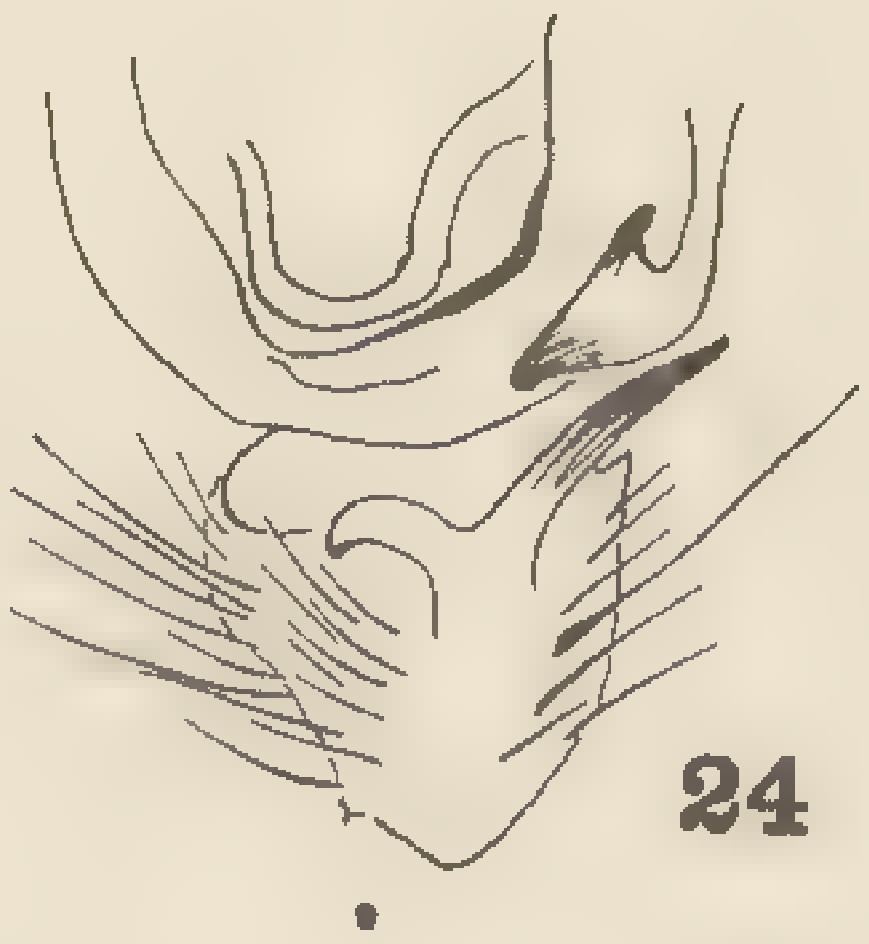

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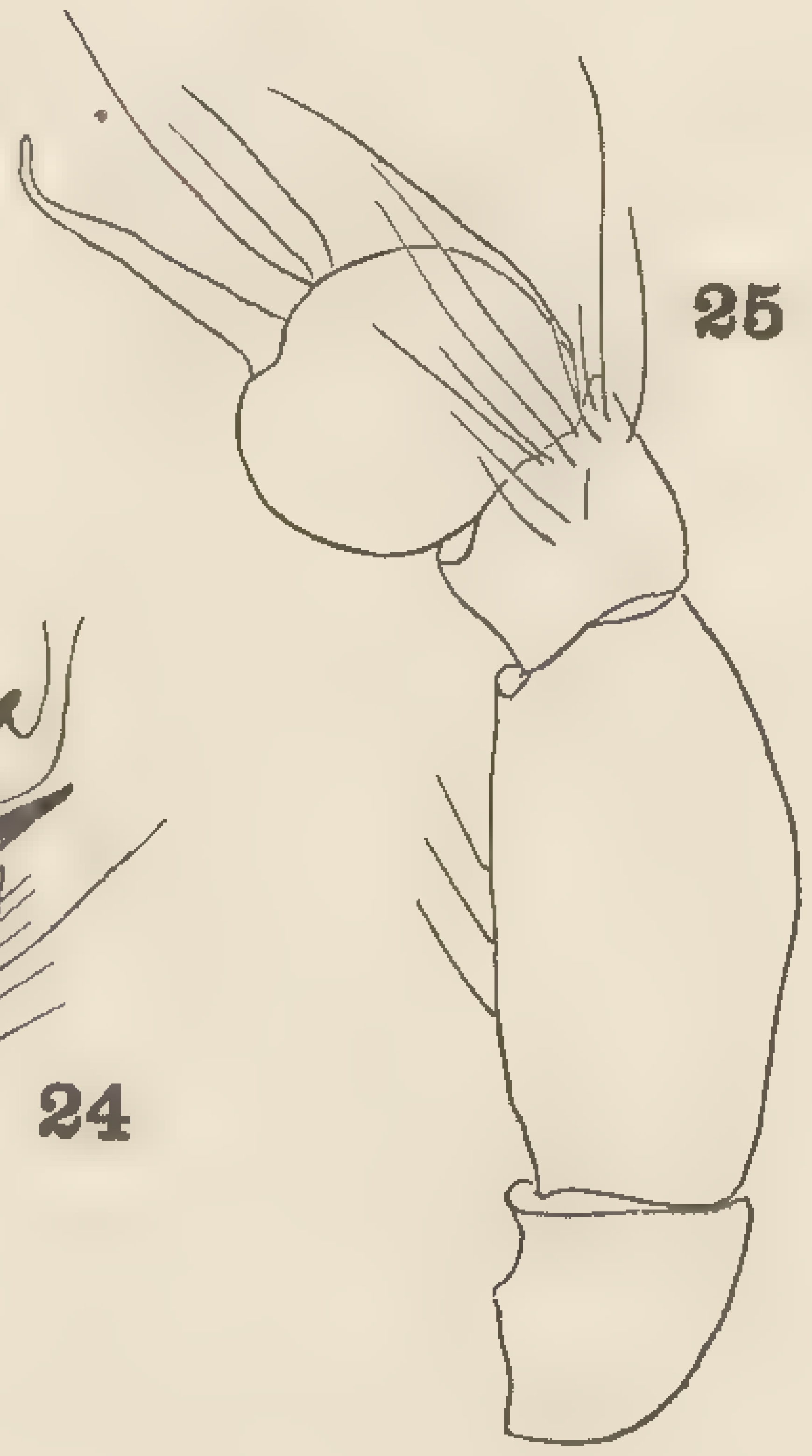

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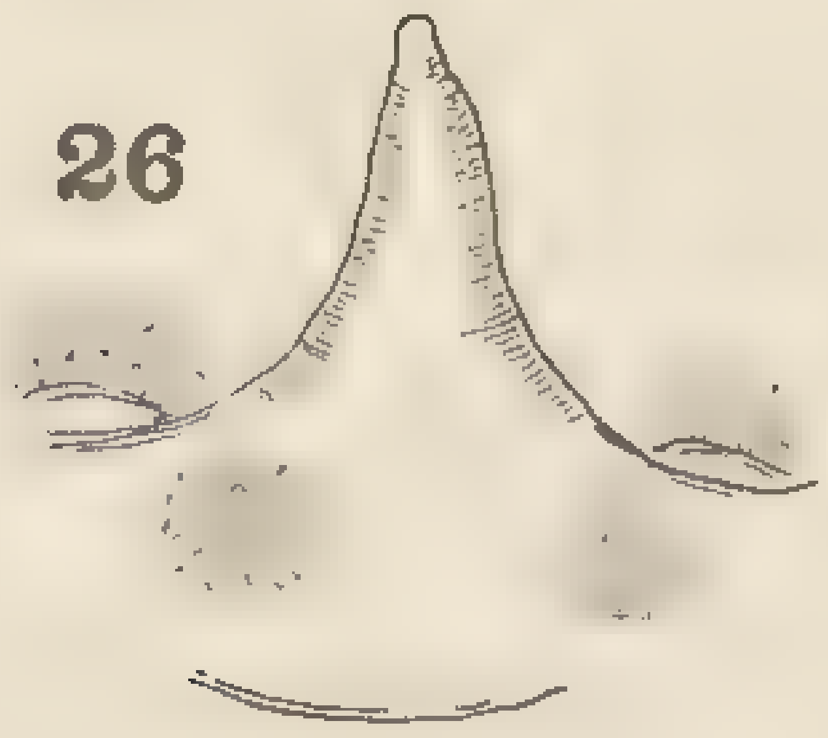

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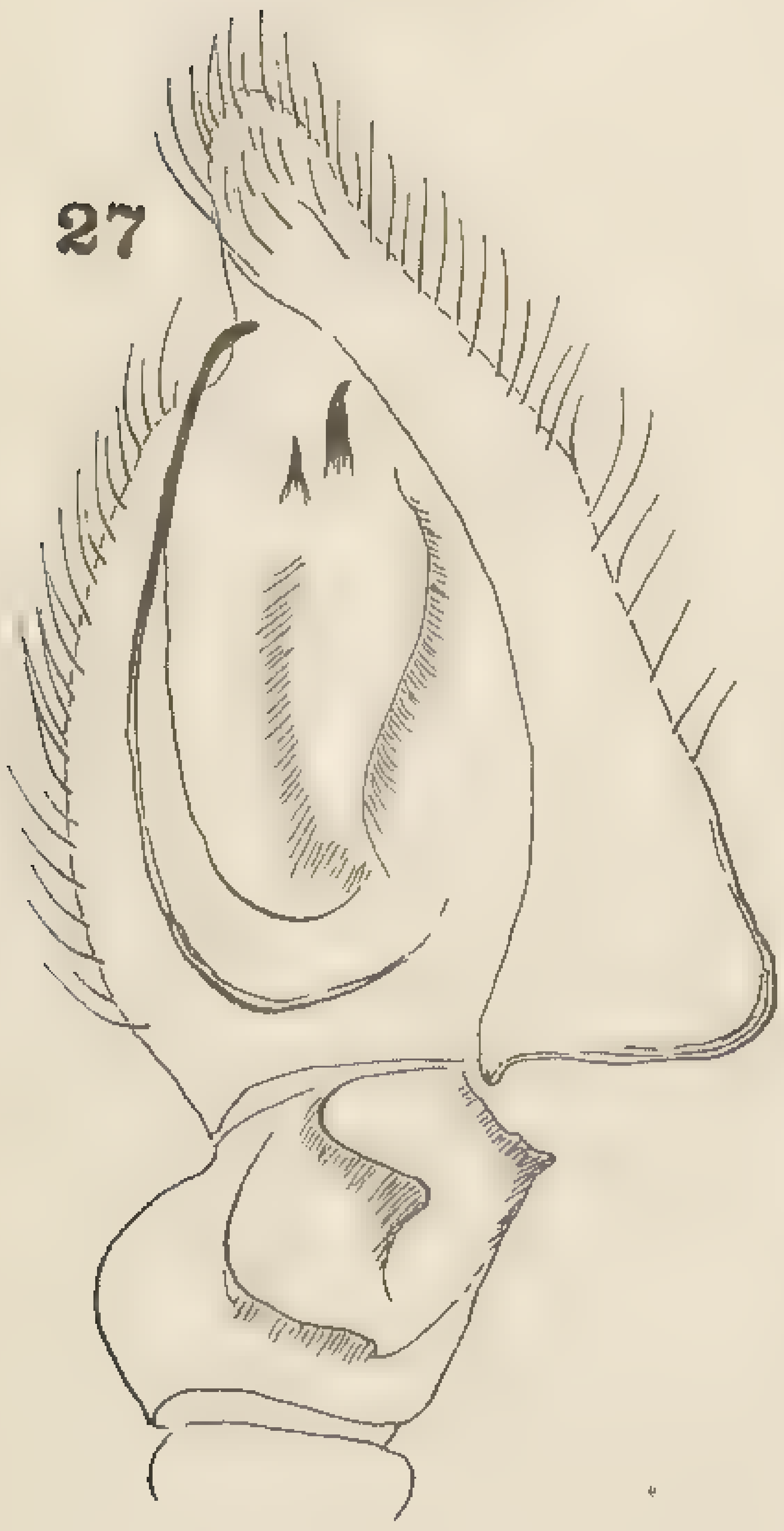

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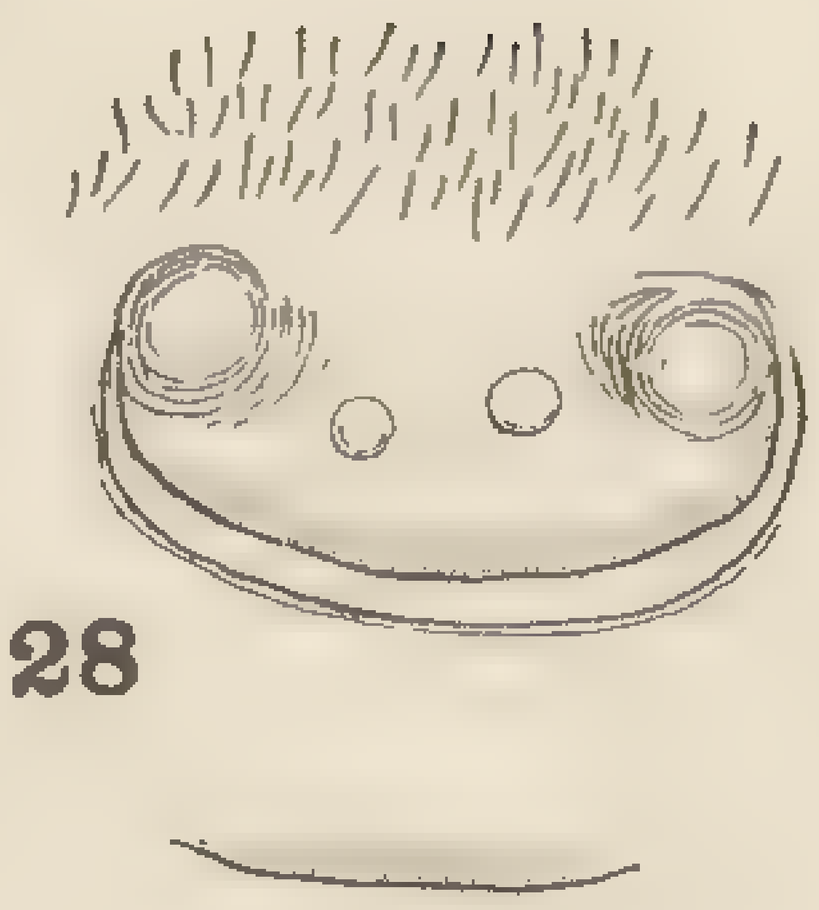

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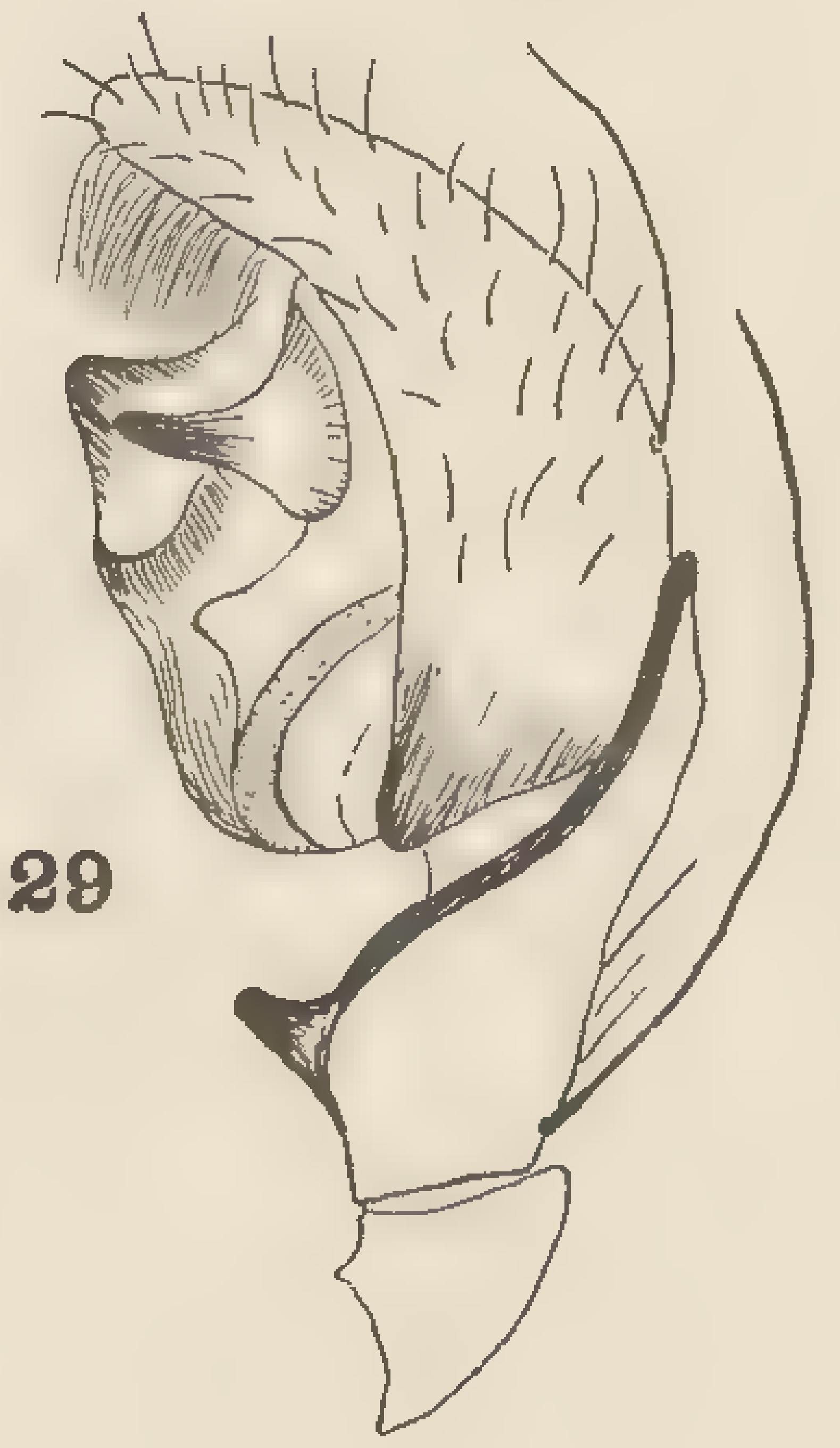

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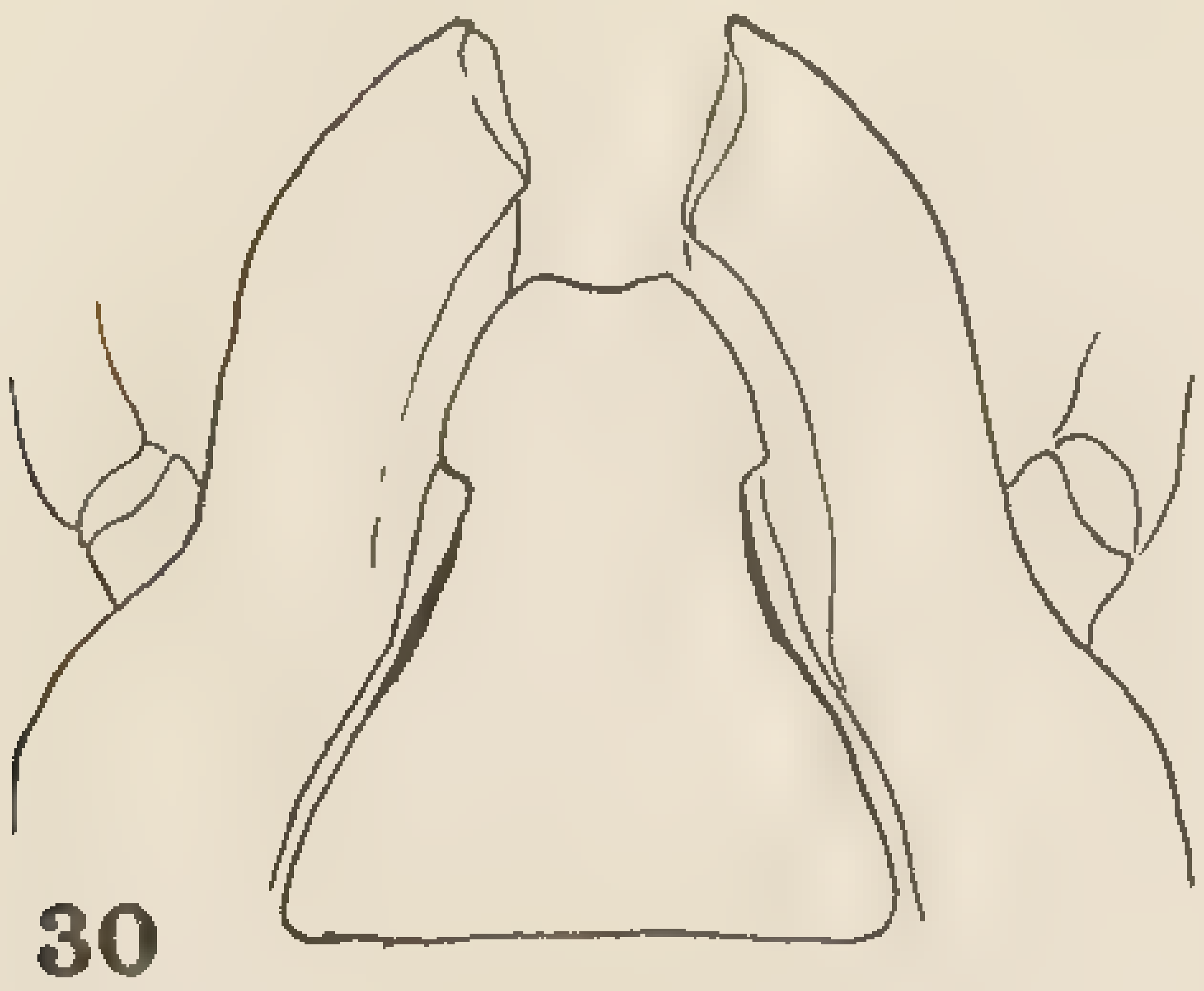
PLATE 4

PLATE 4

Fig. 30. *Drymusa simoni* spec. nov., labium and maxillae.
Fig. 31. *Drymusa simoni* spec. nov., femur of palpus, ventral.
Fig. 32. *Drymusa simoni* spec. nov., abdomen, lateral view.
Fig. 33. *Drymusa simoni* spec. nov., abdomen, ventral view.
Fig. 34. *Modisimus fuscus* spec. nov., head and mandibles of the male.
Fig. 35. *Drymusa simoni* spec. nov., cephalothorax, lateral view.
Fig. 36. *Modisimus fuscus* spec. nov., left palpus, retrolateral.
Fig. 37. *Modisimus fuscus* spec. nov., left palpus, prolateral.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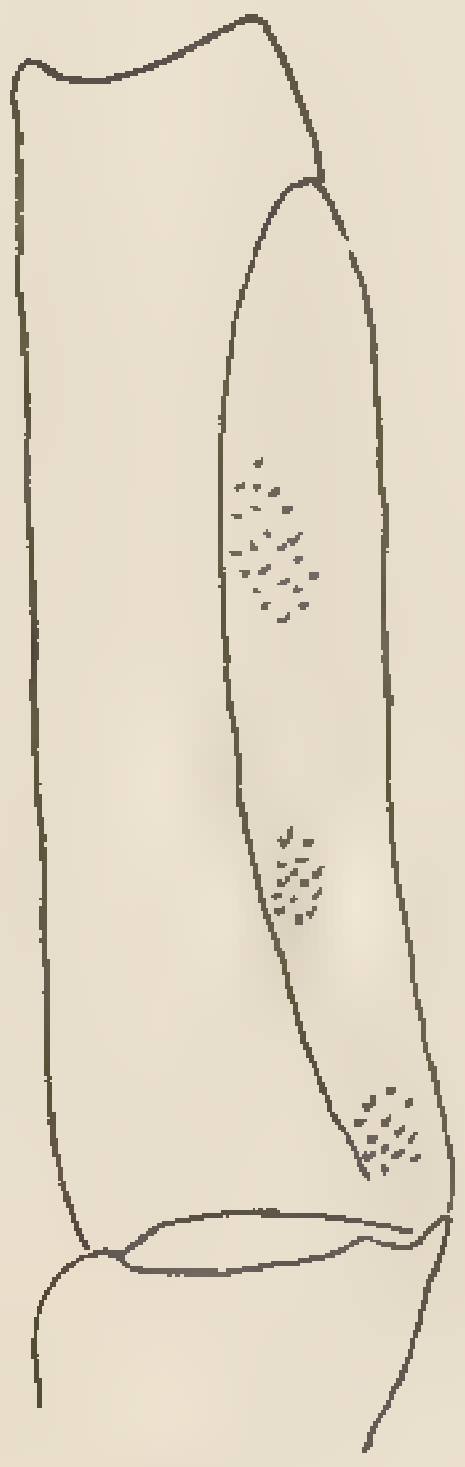
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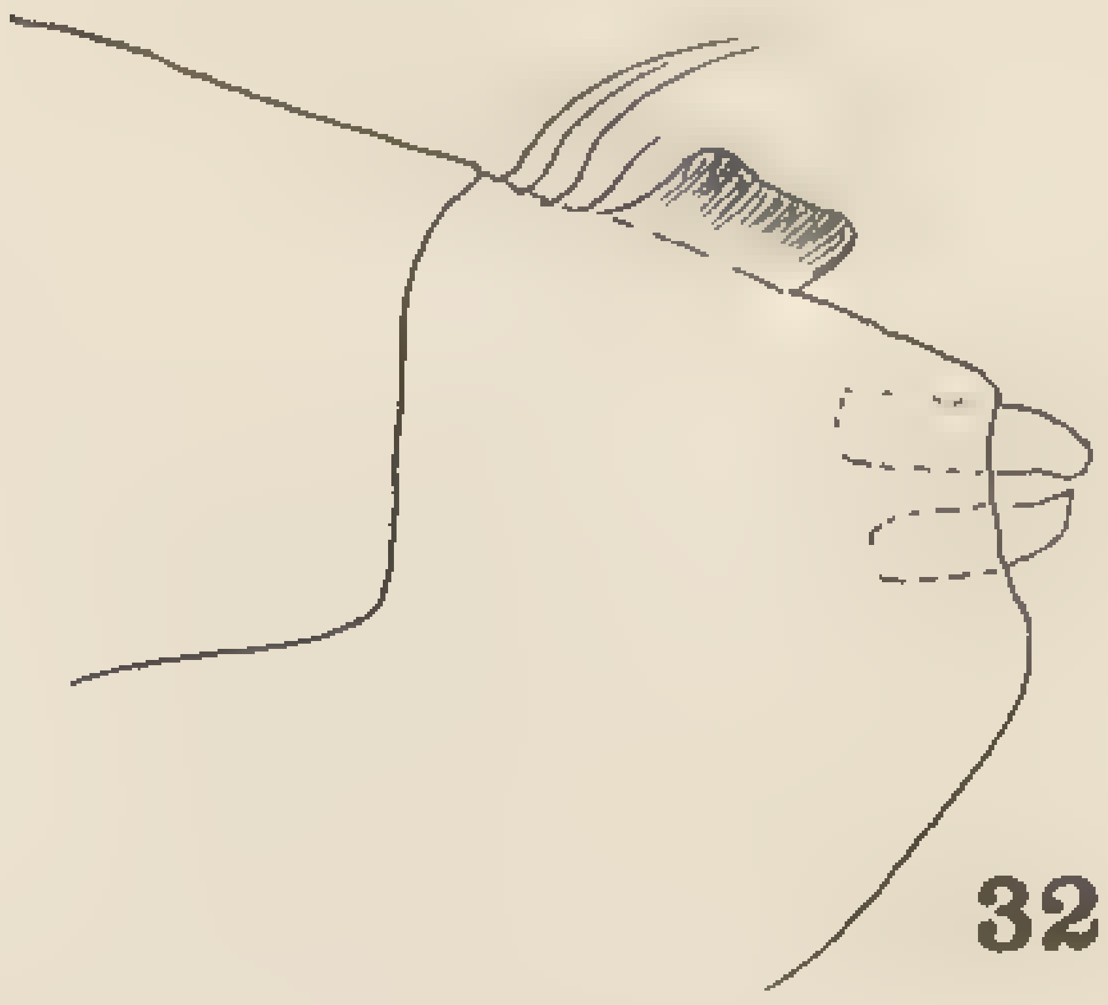
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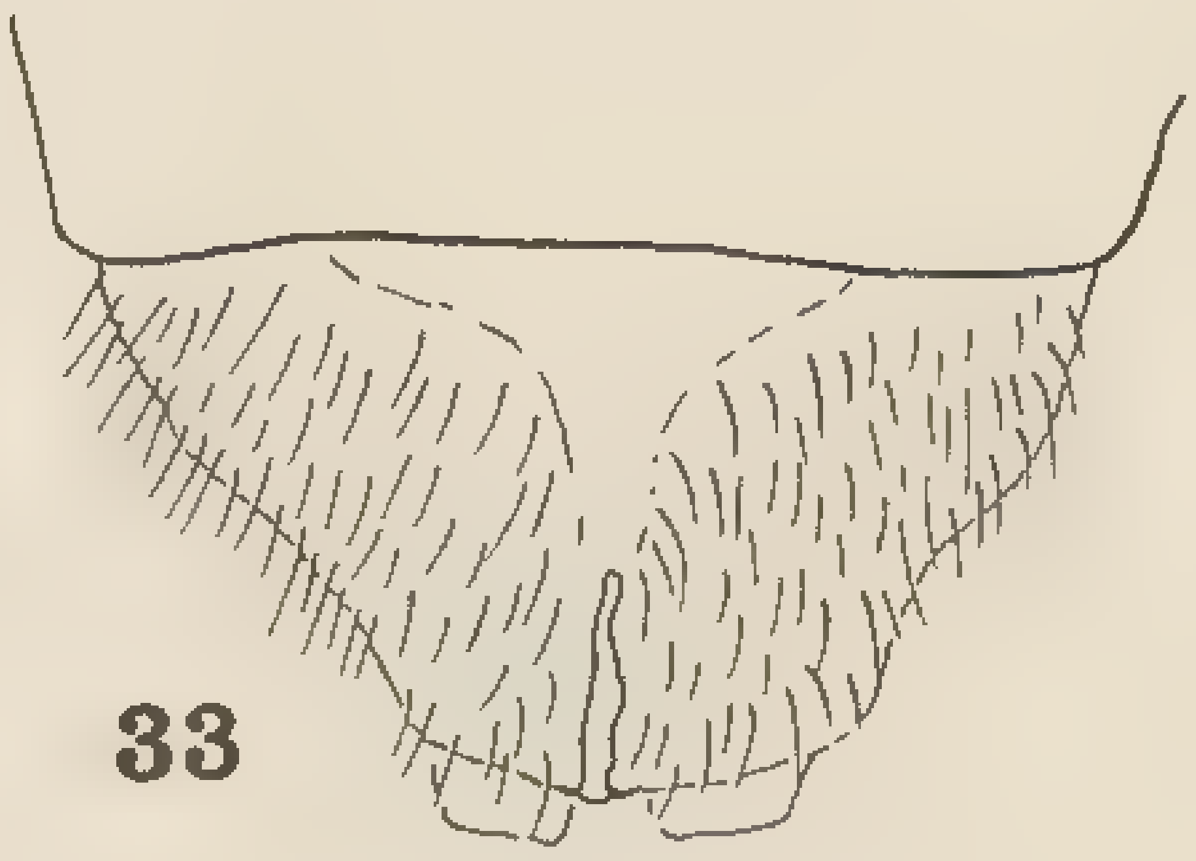
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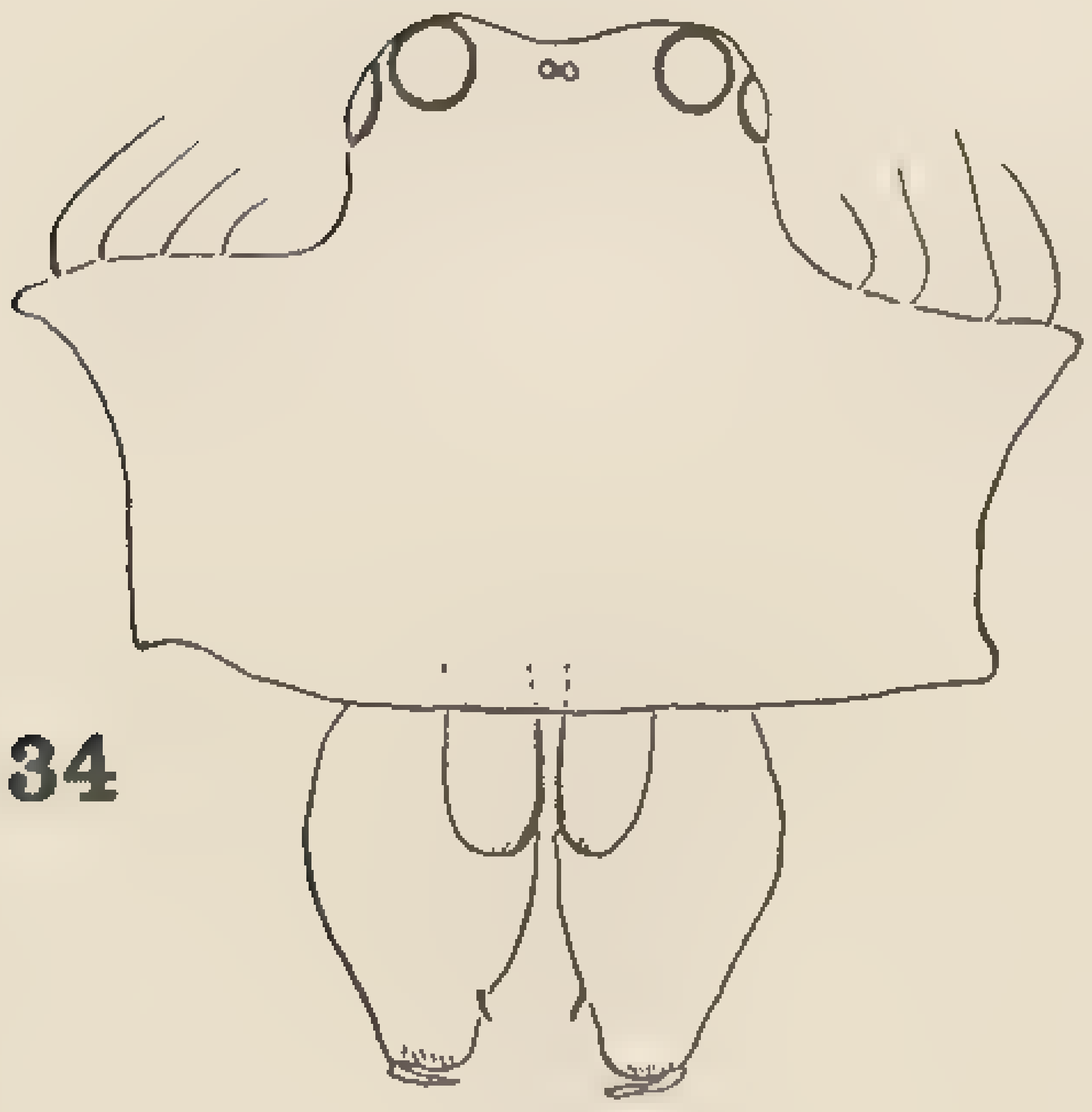
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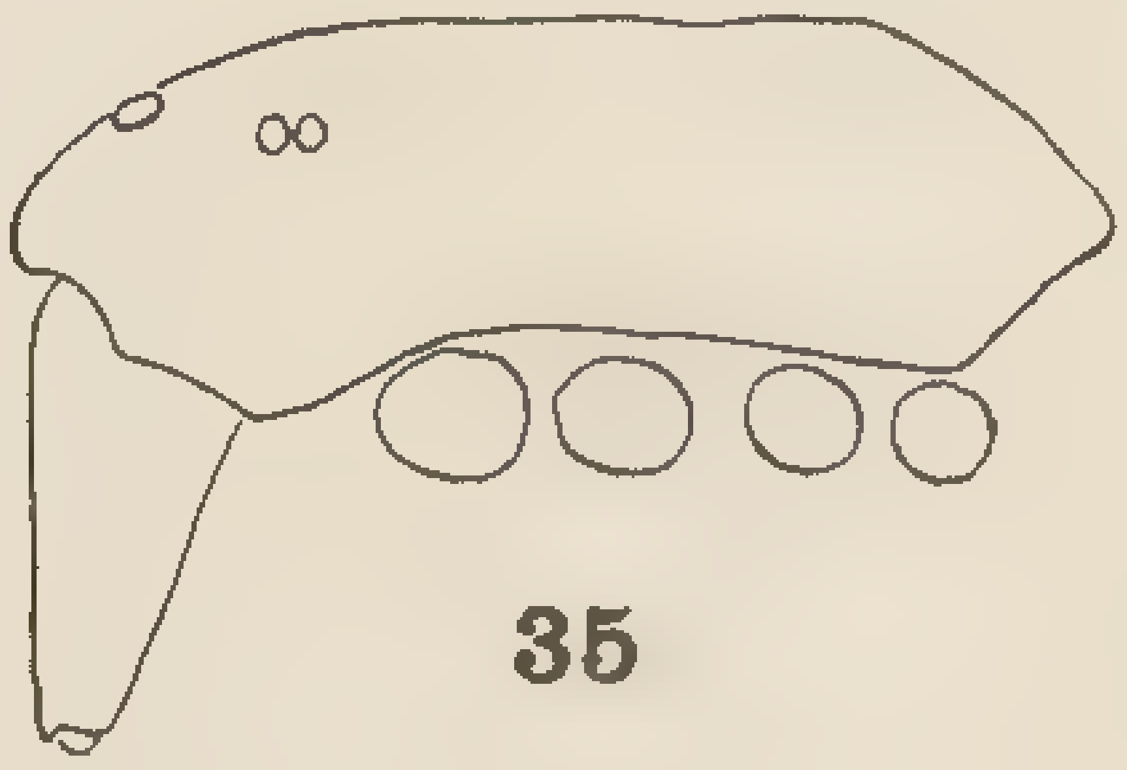
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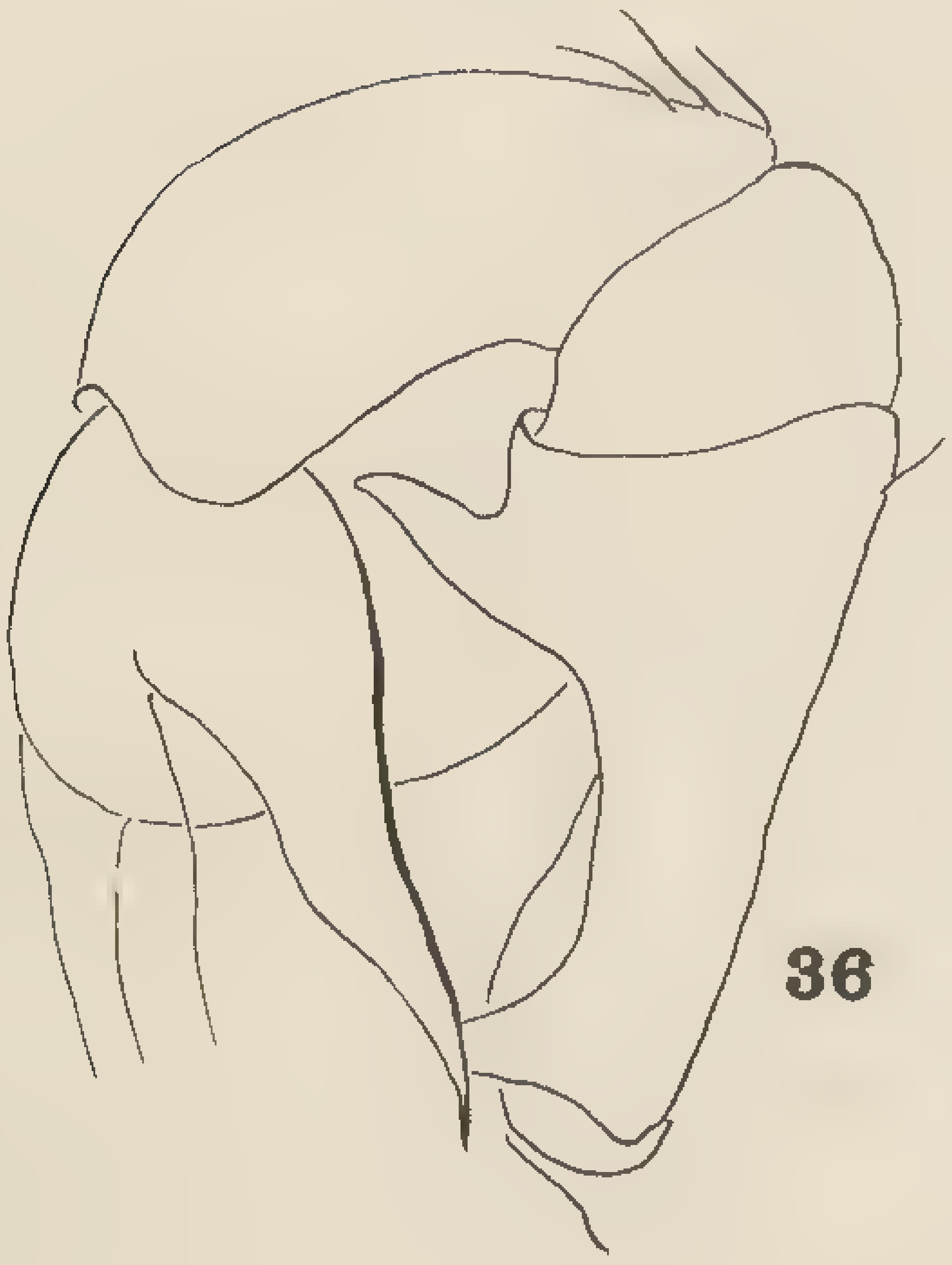
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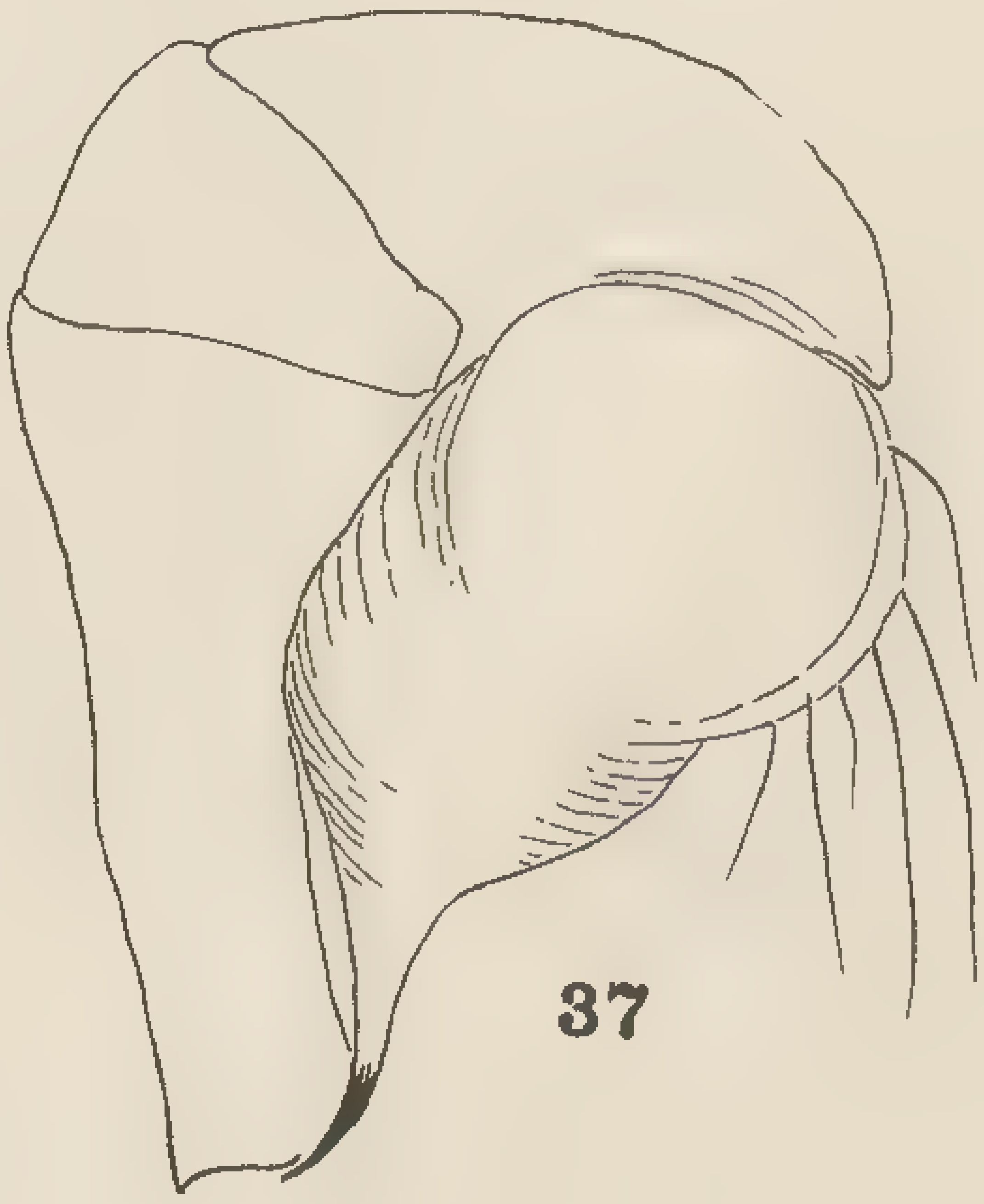
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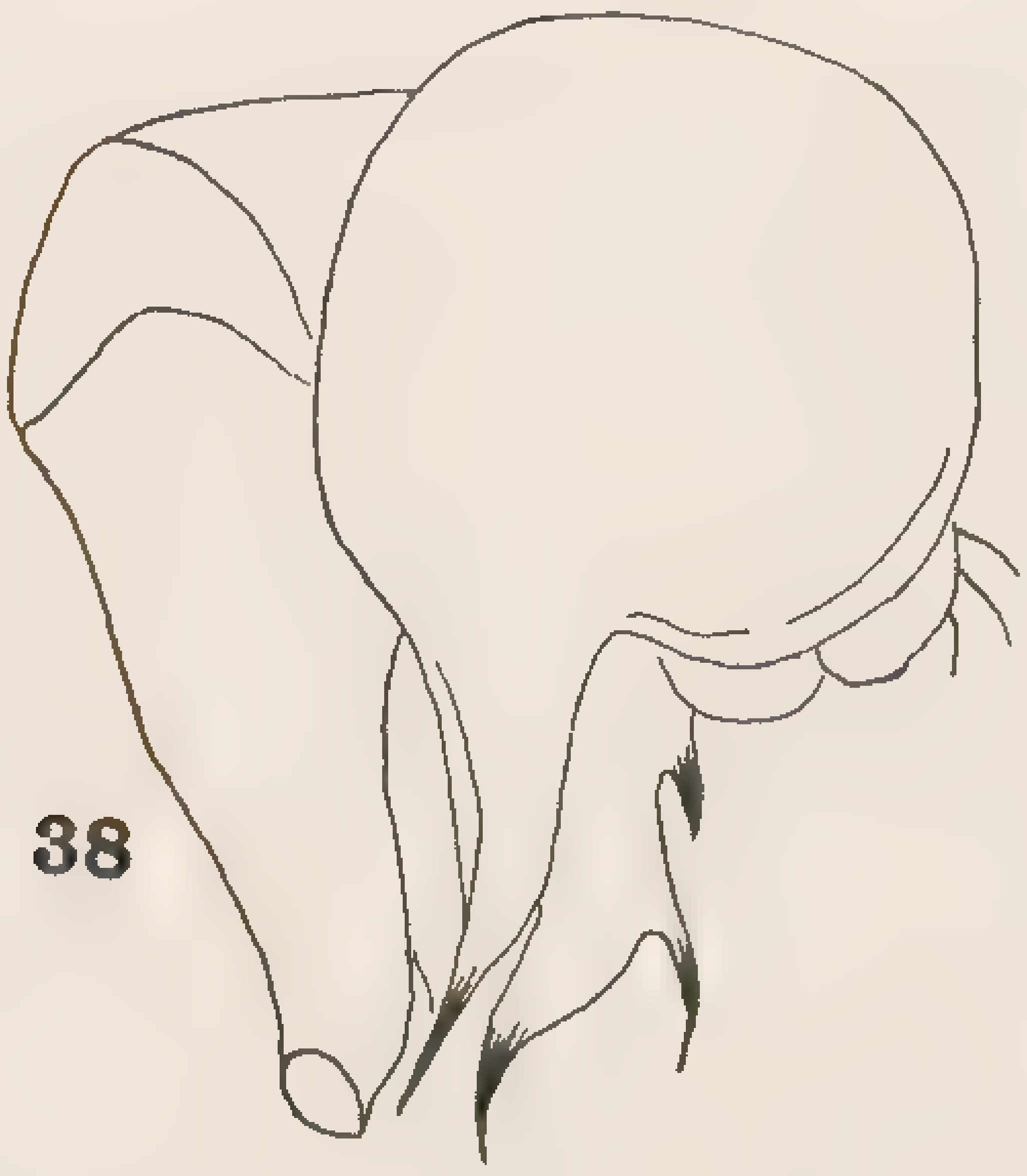
PLATE 5

PLATE 5

Fig. 38. *Modisimus glaucus* Simon, left palpus, prolateral.
Fig. 39. *Modisimus femoratus* spec. nov., left palpus, prolateral.
Fig. 40. *Modisimus vittatus* spec. nov., left palpus, retrolateral.
Fig. 41. *Modisimus glaucus* Simon, left palpus, retrolateral.
Fig. 42. *Modisimus femoratus* spec. nov., mandibles of the male.
Fig. 43. *Modisimus vittatus* spec. nov., left palpus, prolateral.
Fig. 44. *Modisimus vittatus* spec. nov., epigynum.
Fig. 45. *Modisimus fuscus* spec. nov., epigynum.



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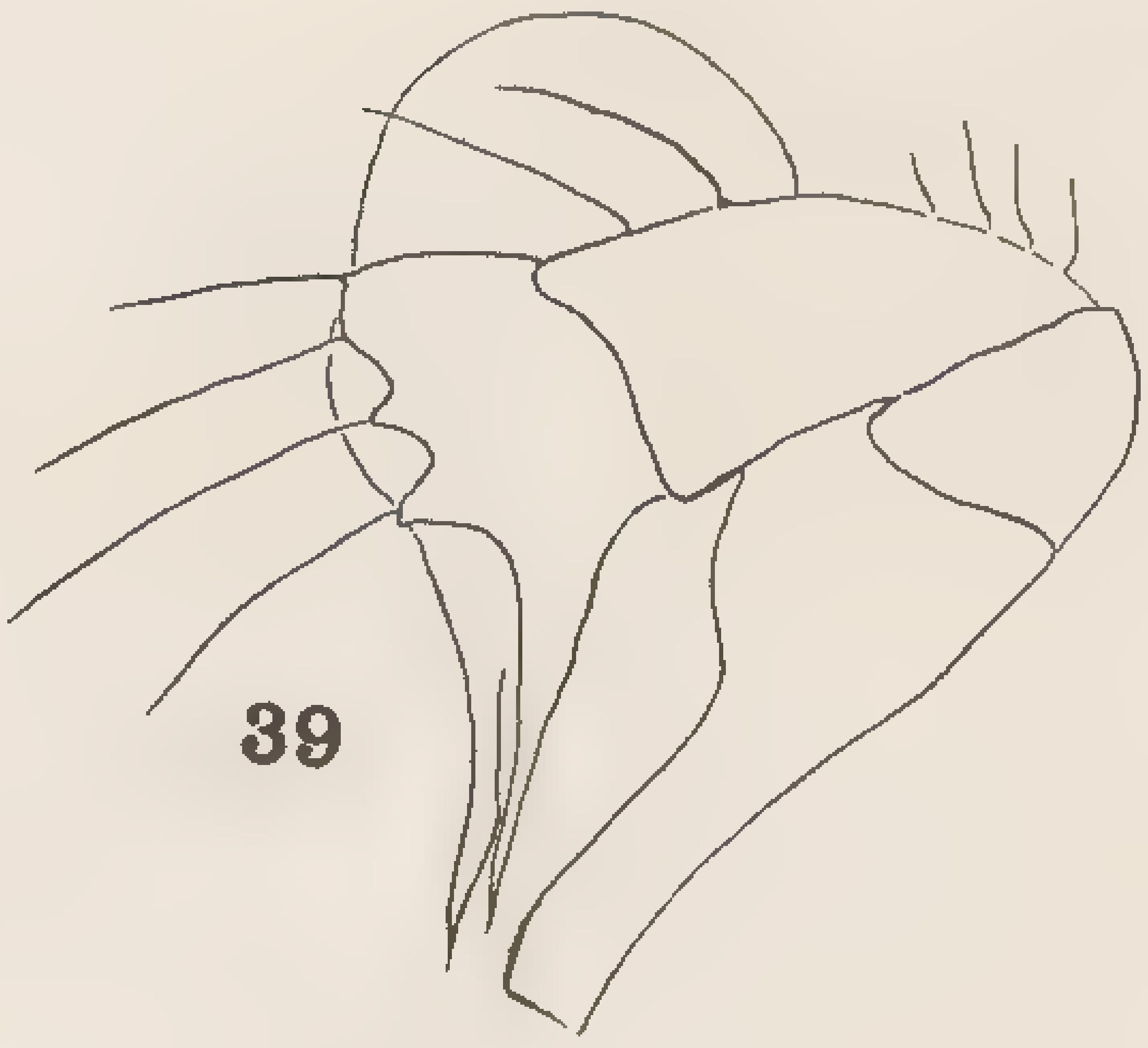

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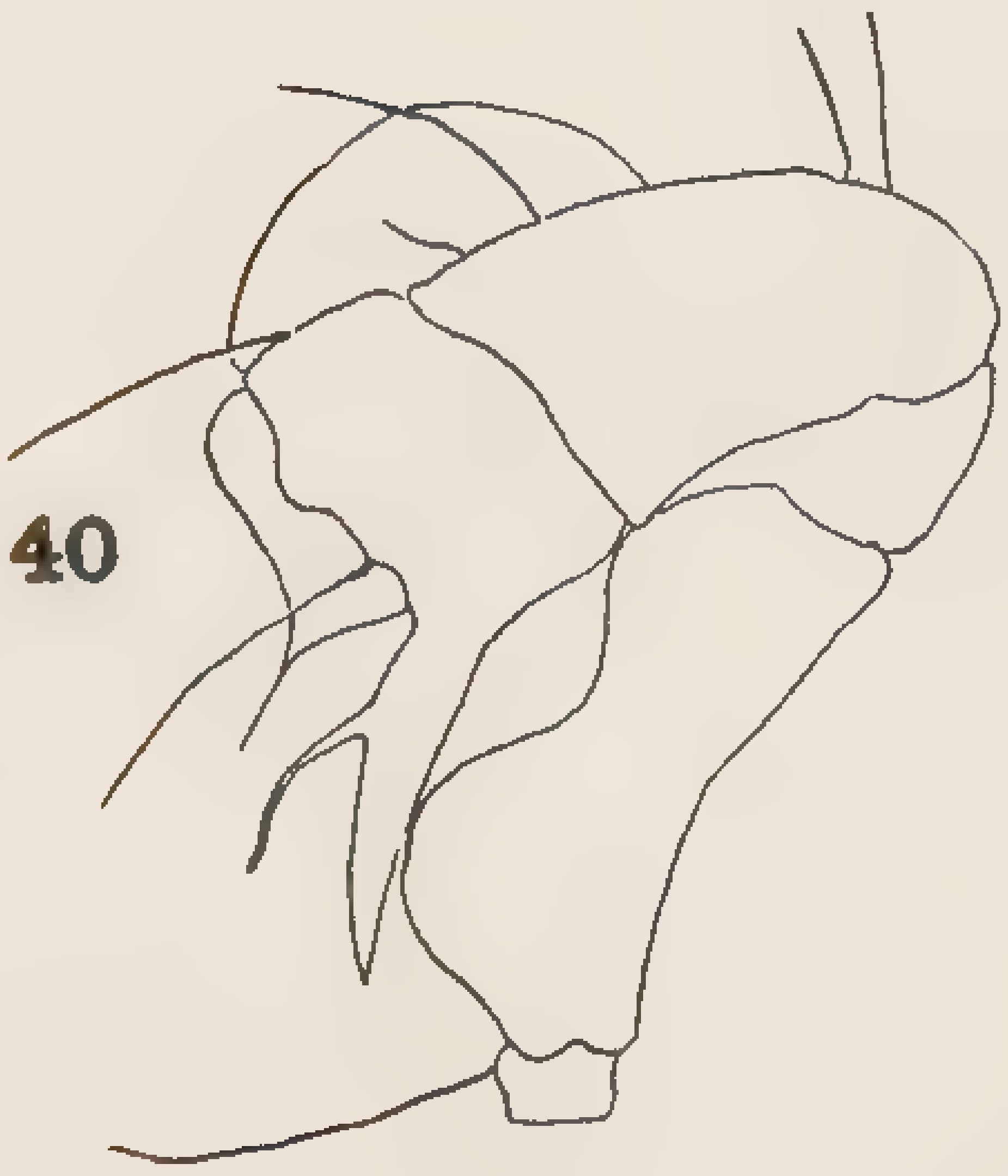

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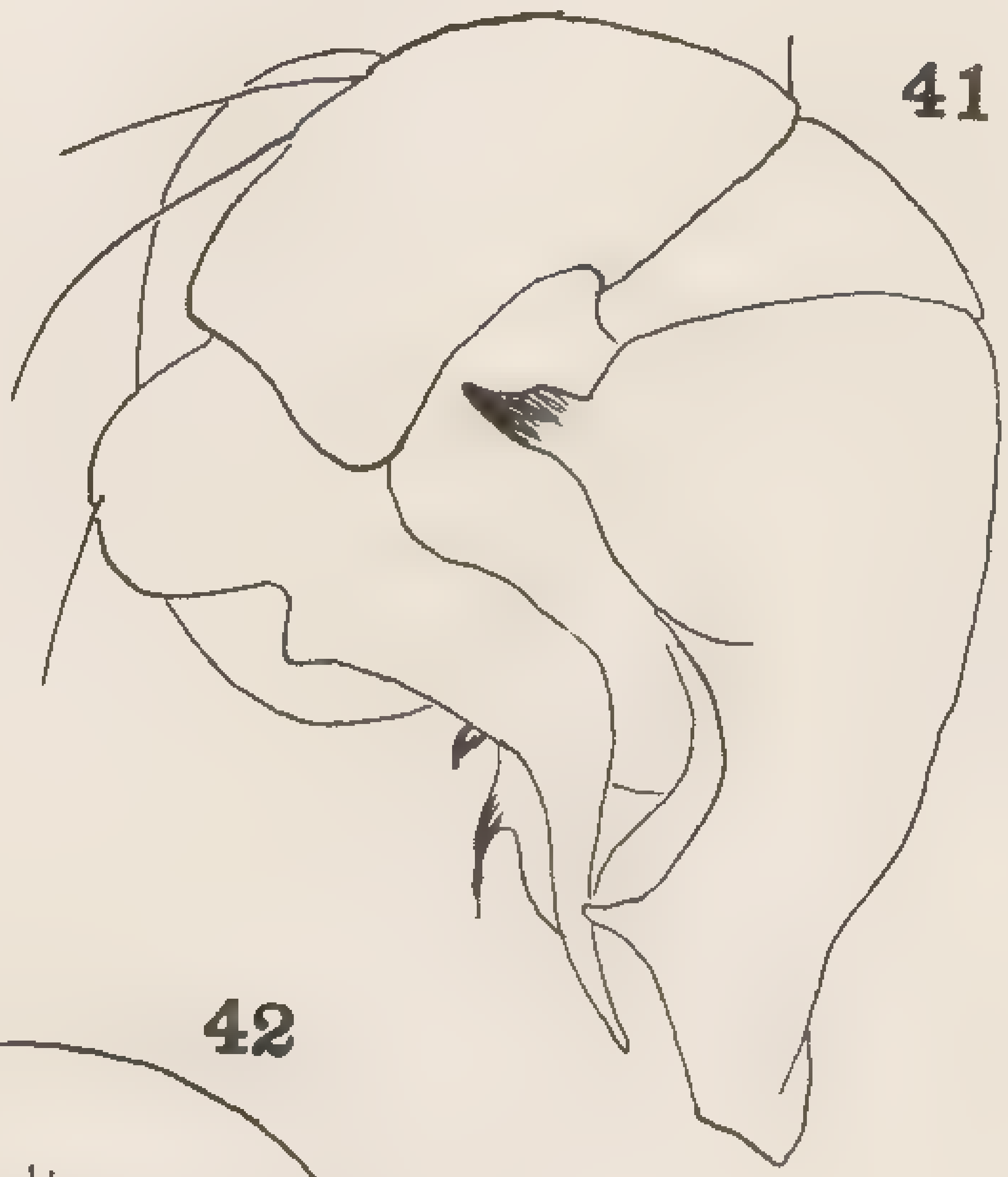

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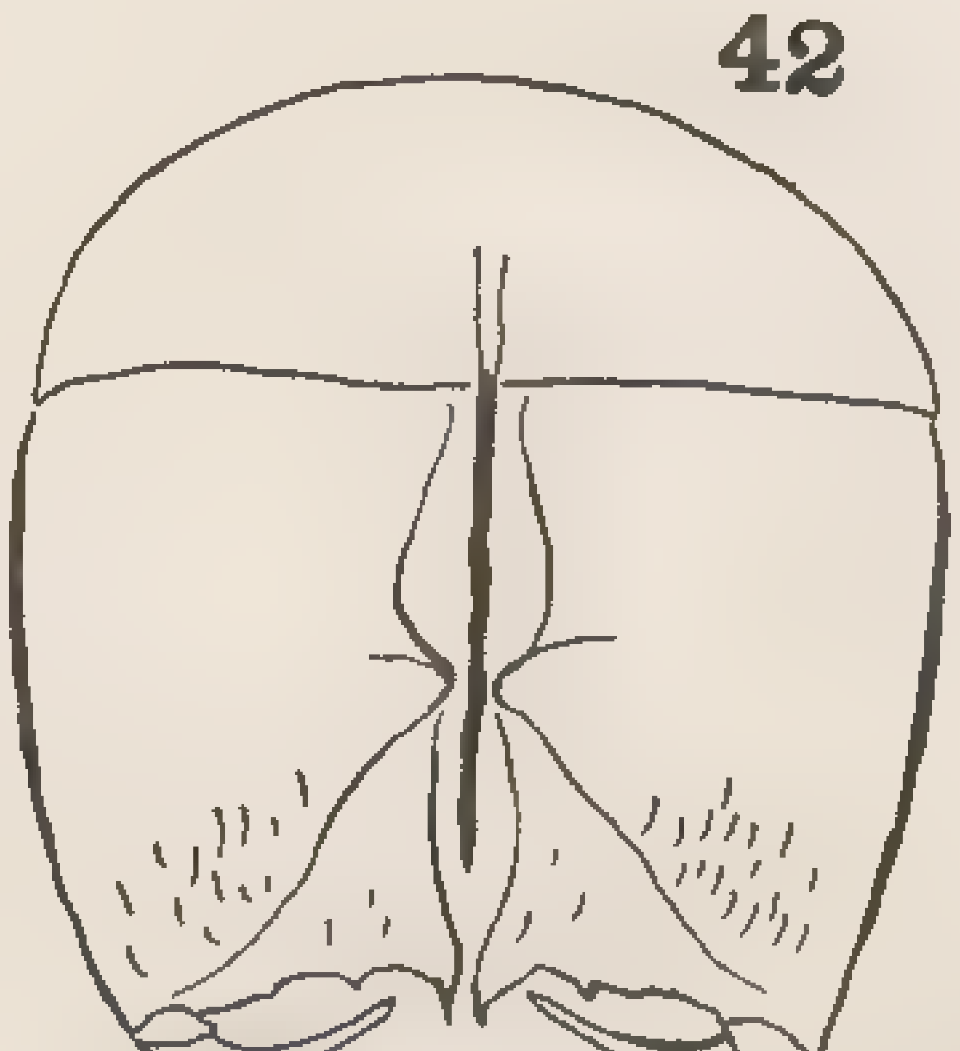

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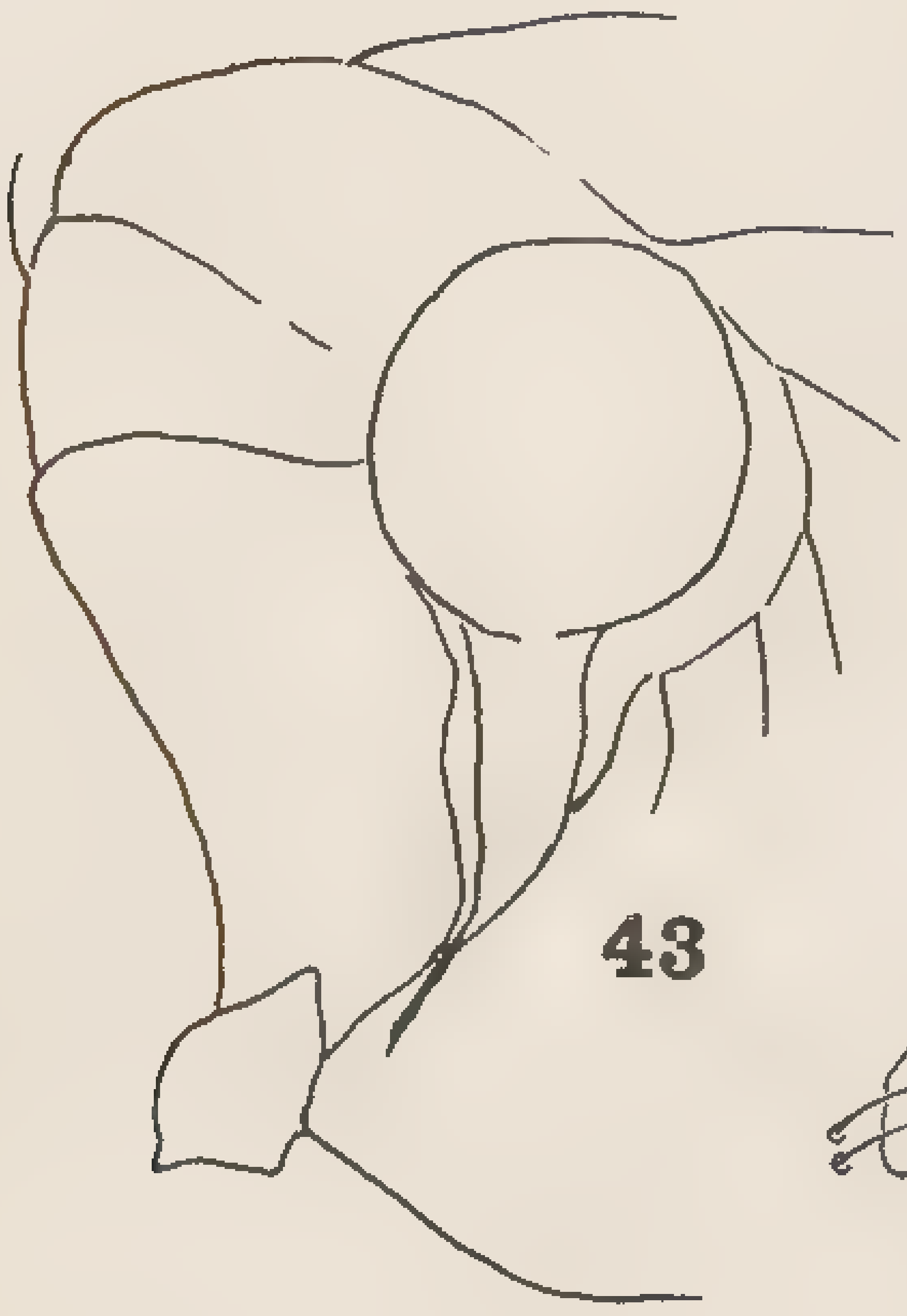

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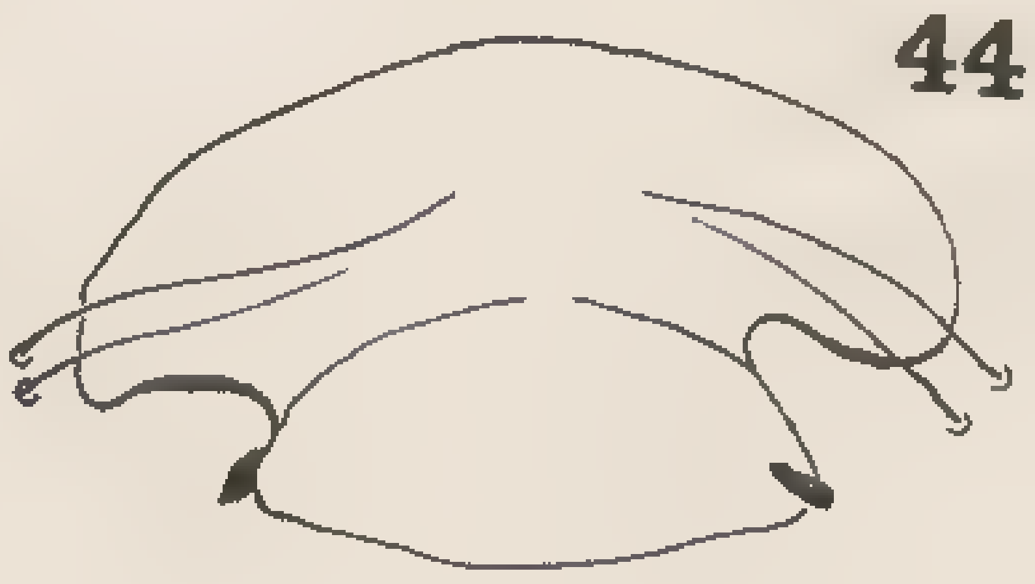

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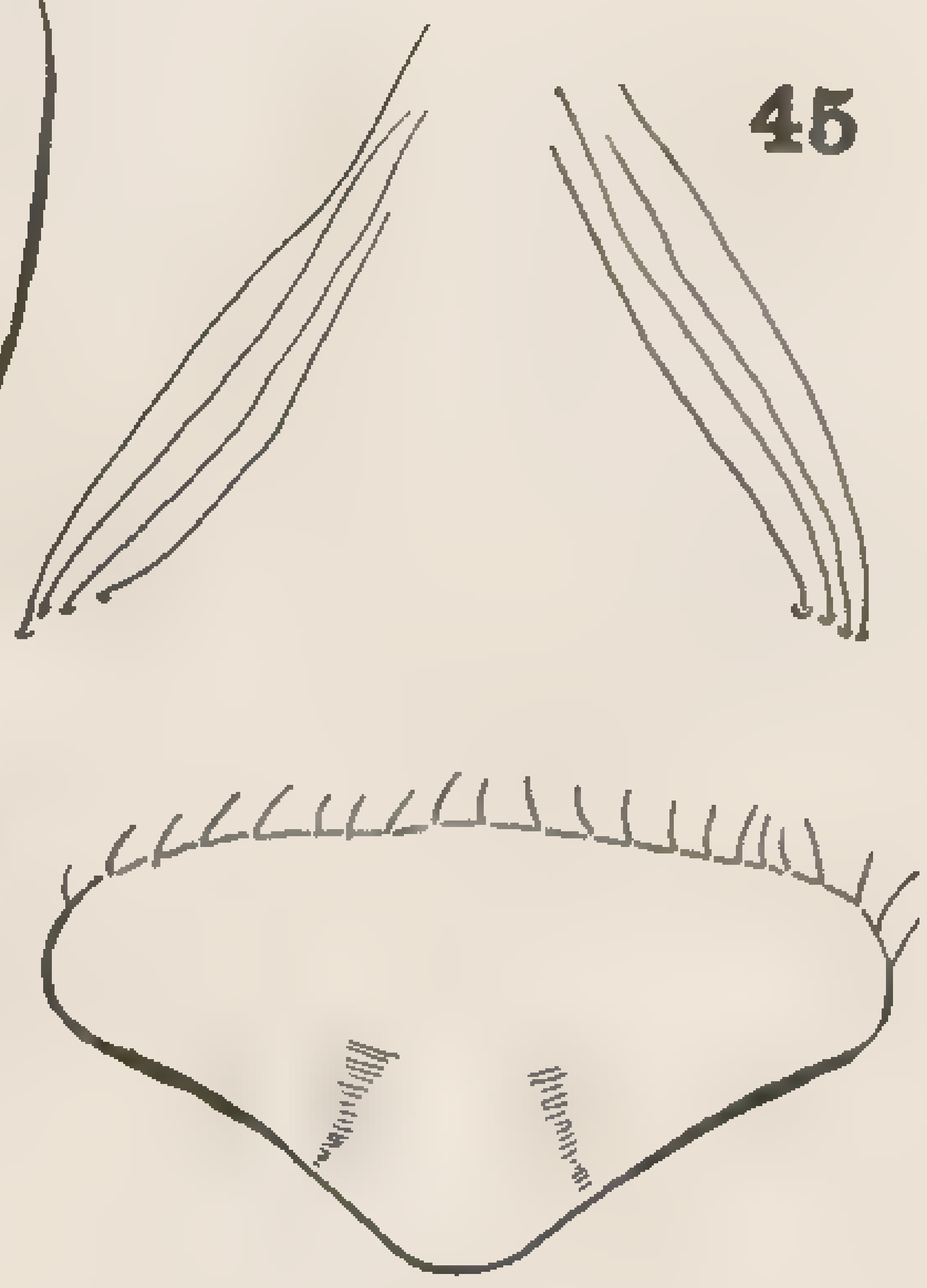

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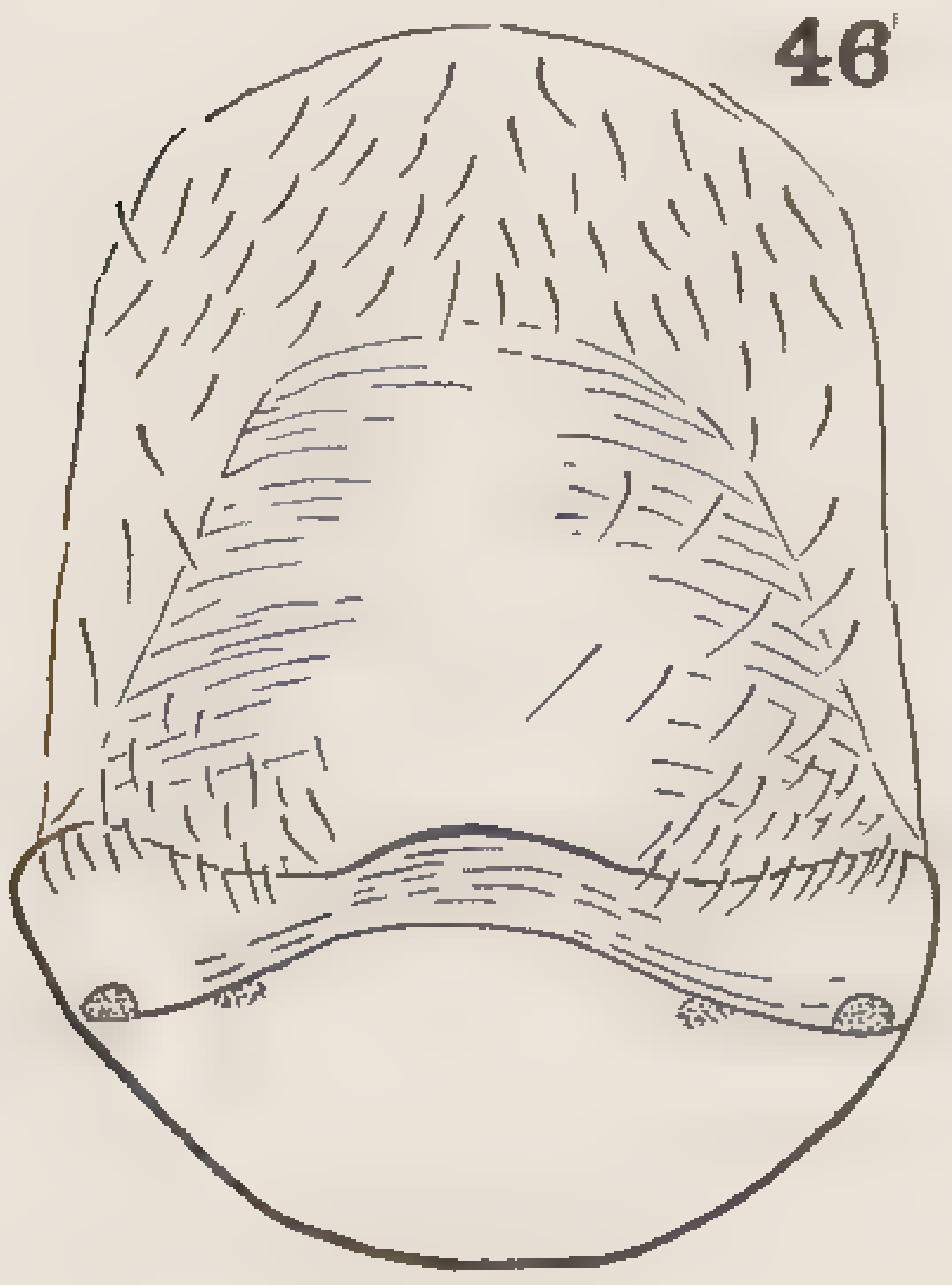
PLATE 6

PLATE 6

Fig. 46. *Blechroscelis serripes* Simon, epigynum.
Fig. 47. *Craspedisia spatulata* spec. nov., left palpus.
Fig. 48. *Craspedisia spatulata* spec. nov., head of the male.
Fig. 49. *Teutana modesta* spec. nov., eyes of the female.
Fig. 50. *Dipoena morosa* spec. nov., right palpus, retrolateral.
Fig. 51. *Teutana modesta* spec. nov., epigynum.
Fig. 52. *Dipoena morosa* spec. nov., lateral view of male cephalothorax.
Fig. 53. *Dipoena morosa* spec. nov., right palpus, retrolateral.
Fig. 54. *Theridion fuesslyi* Simon, epigynum.
Fig. 55. *Anelosimus fraternus* spec. nov., left palpus, prolateral.
Fig. 56. *Modisimus glaucus* Simon, epigynum.
Fig. 57. *Anelosimus fraternus* spec. nov., left palpus, retrolateral.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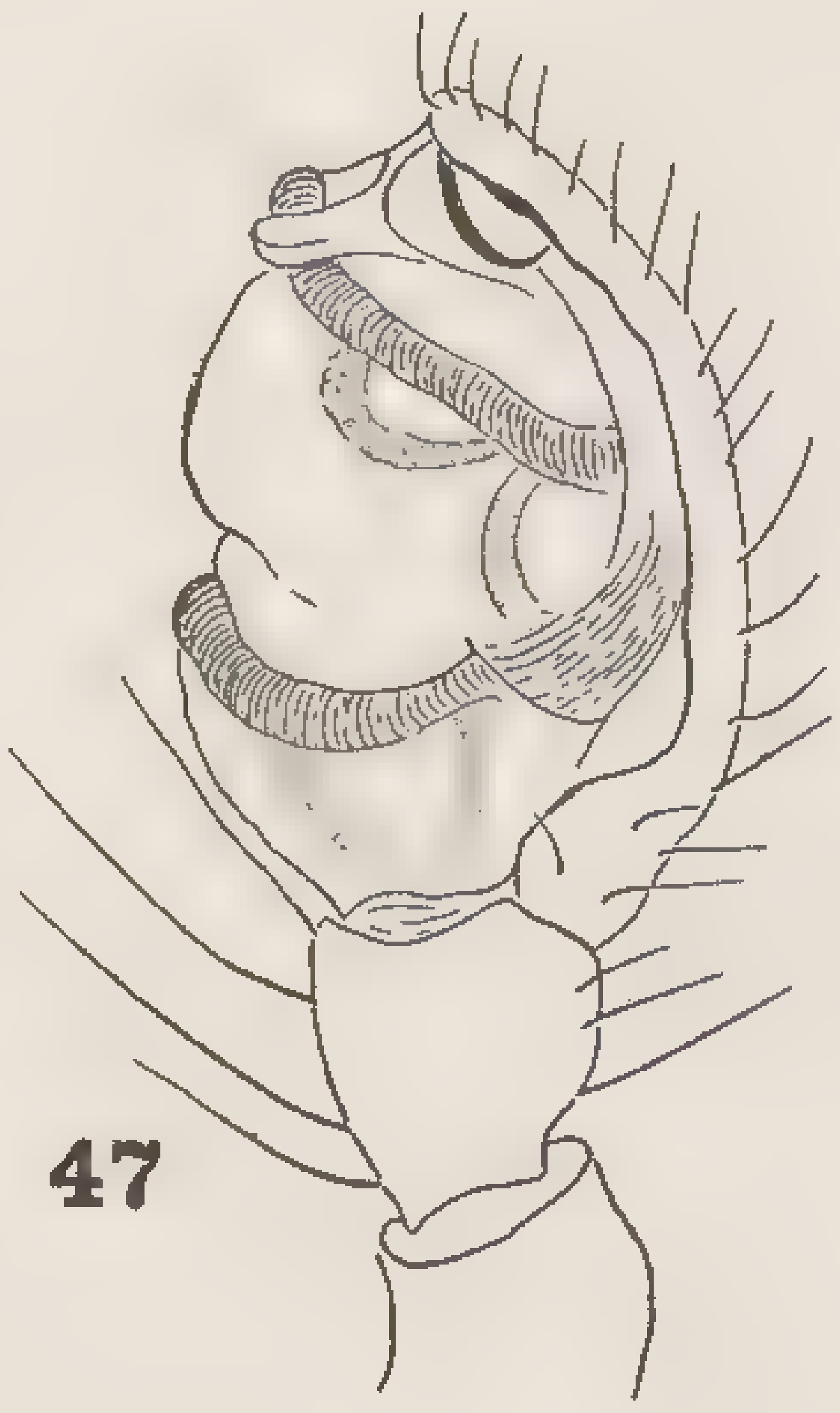
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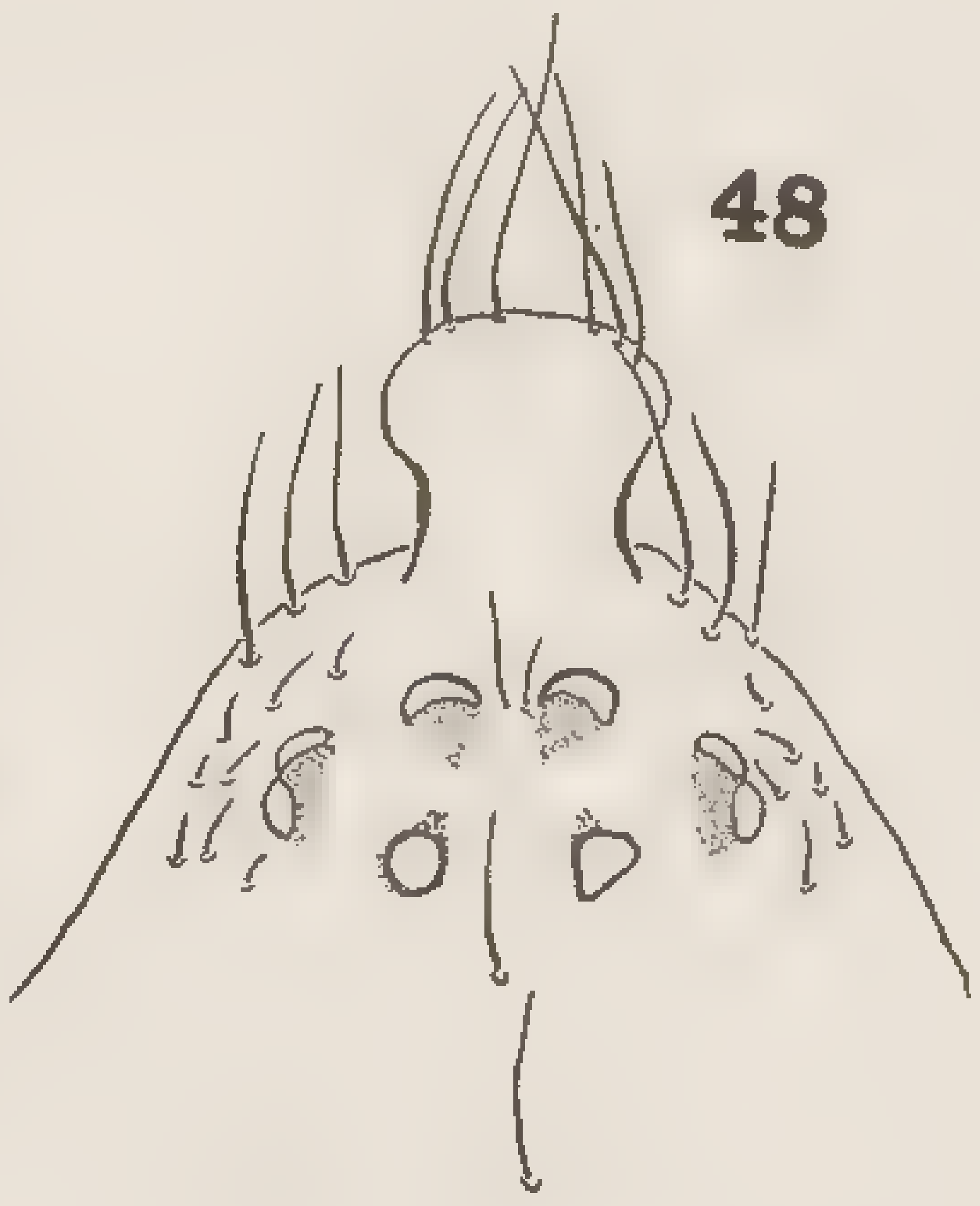
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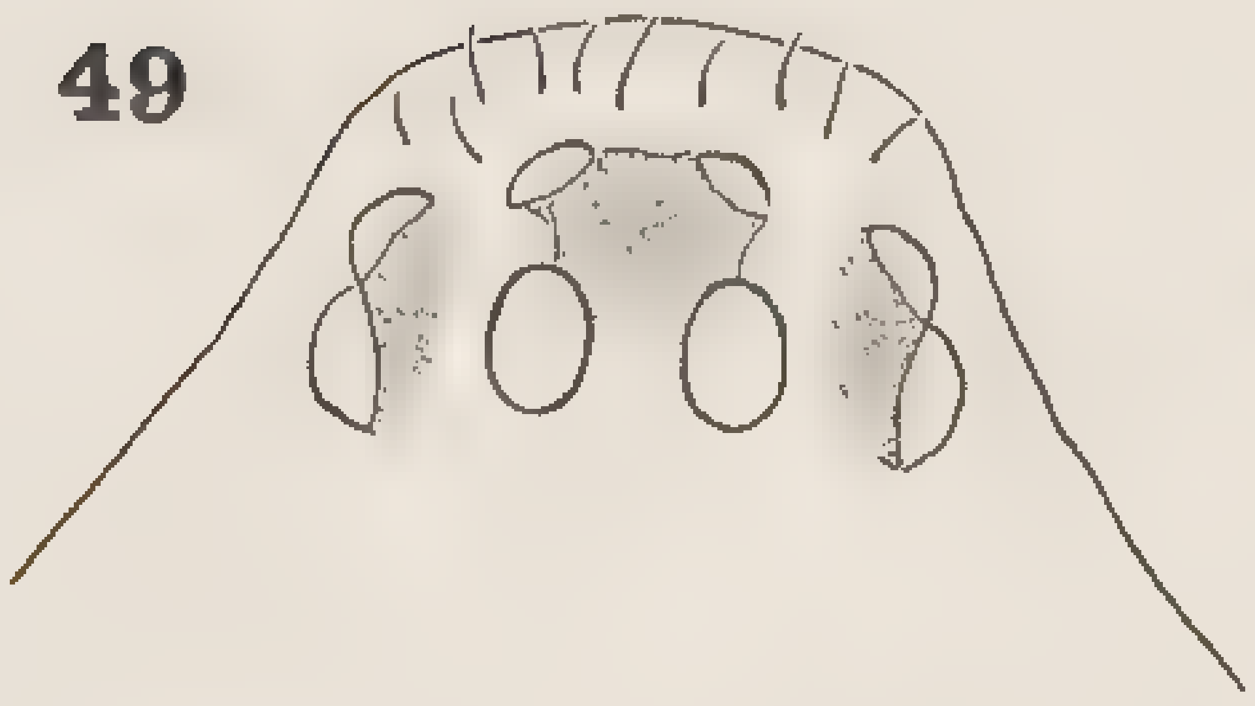
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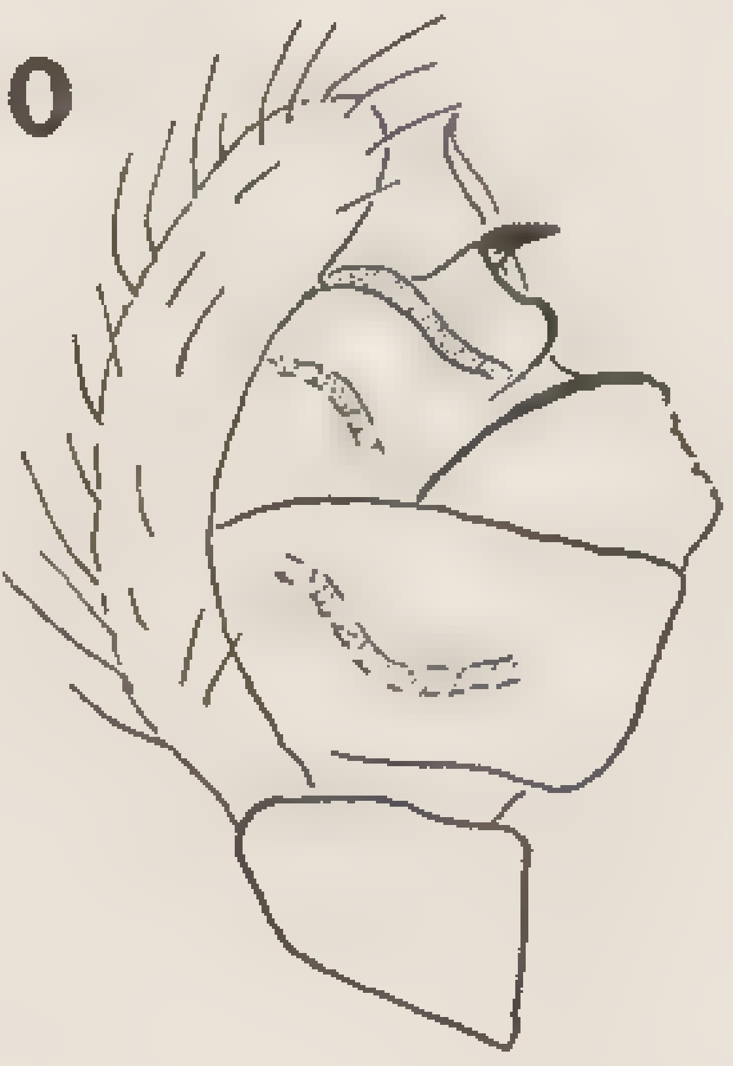
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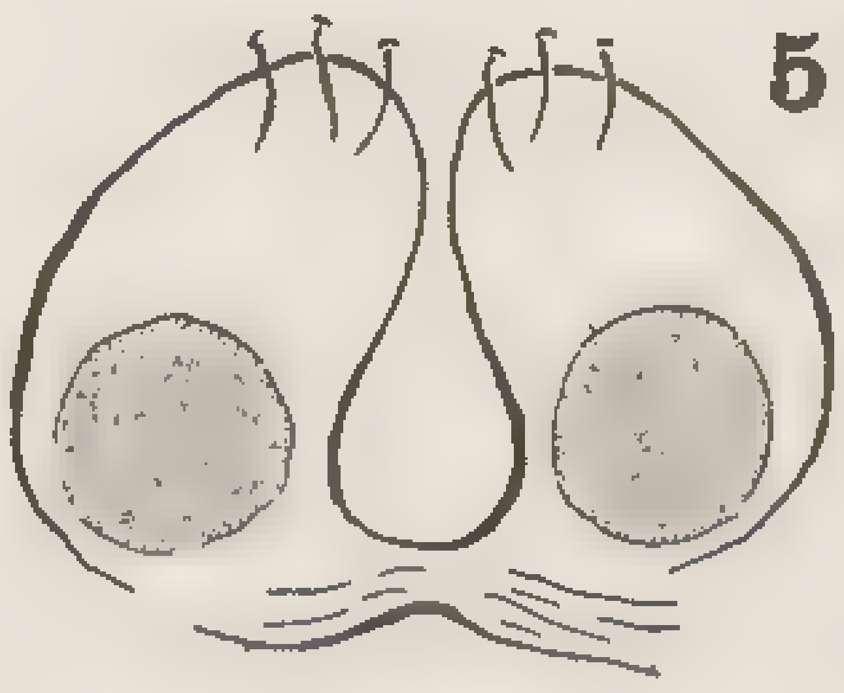
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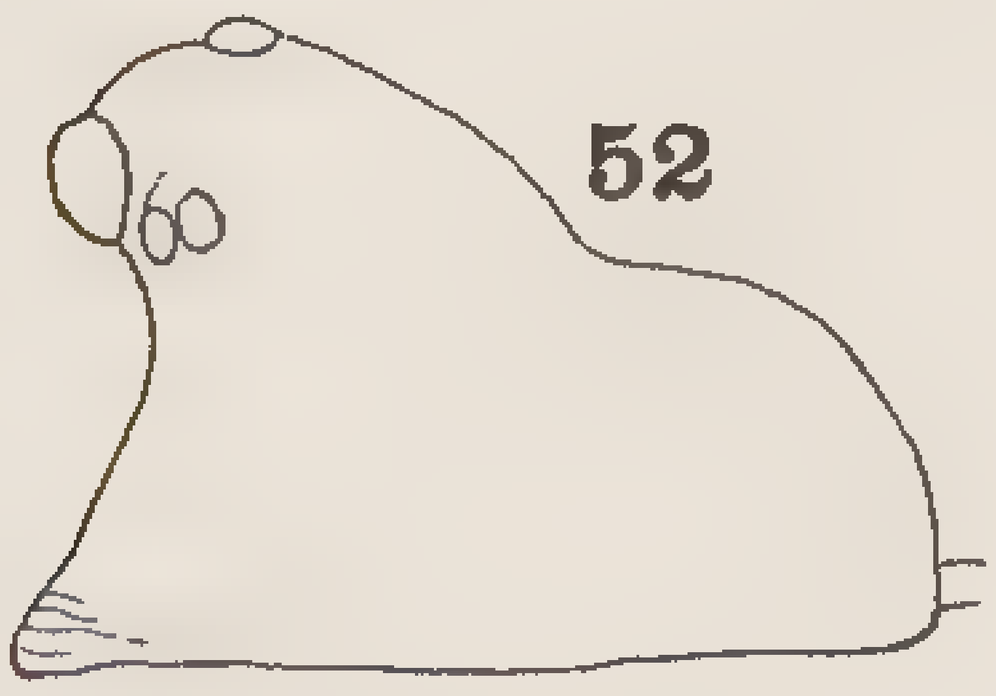
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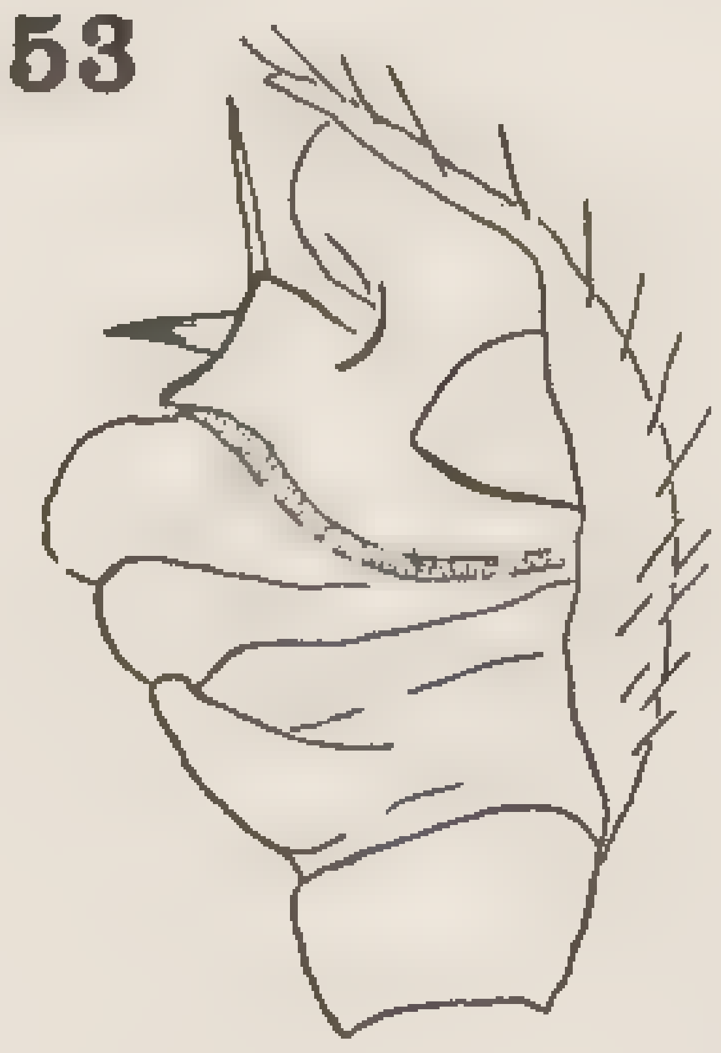
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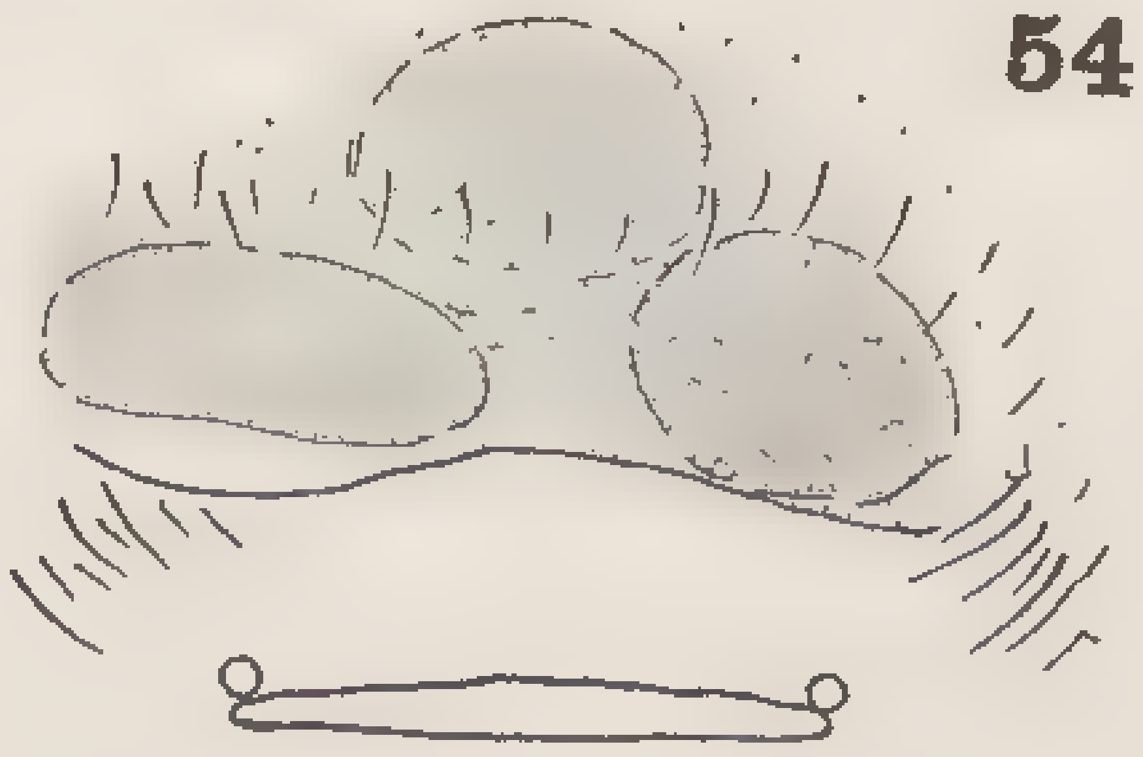
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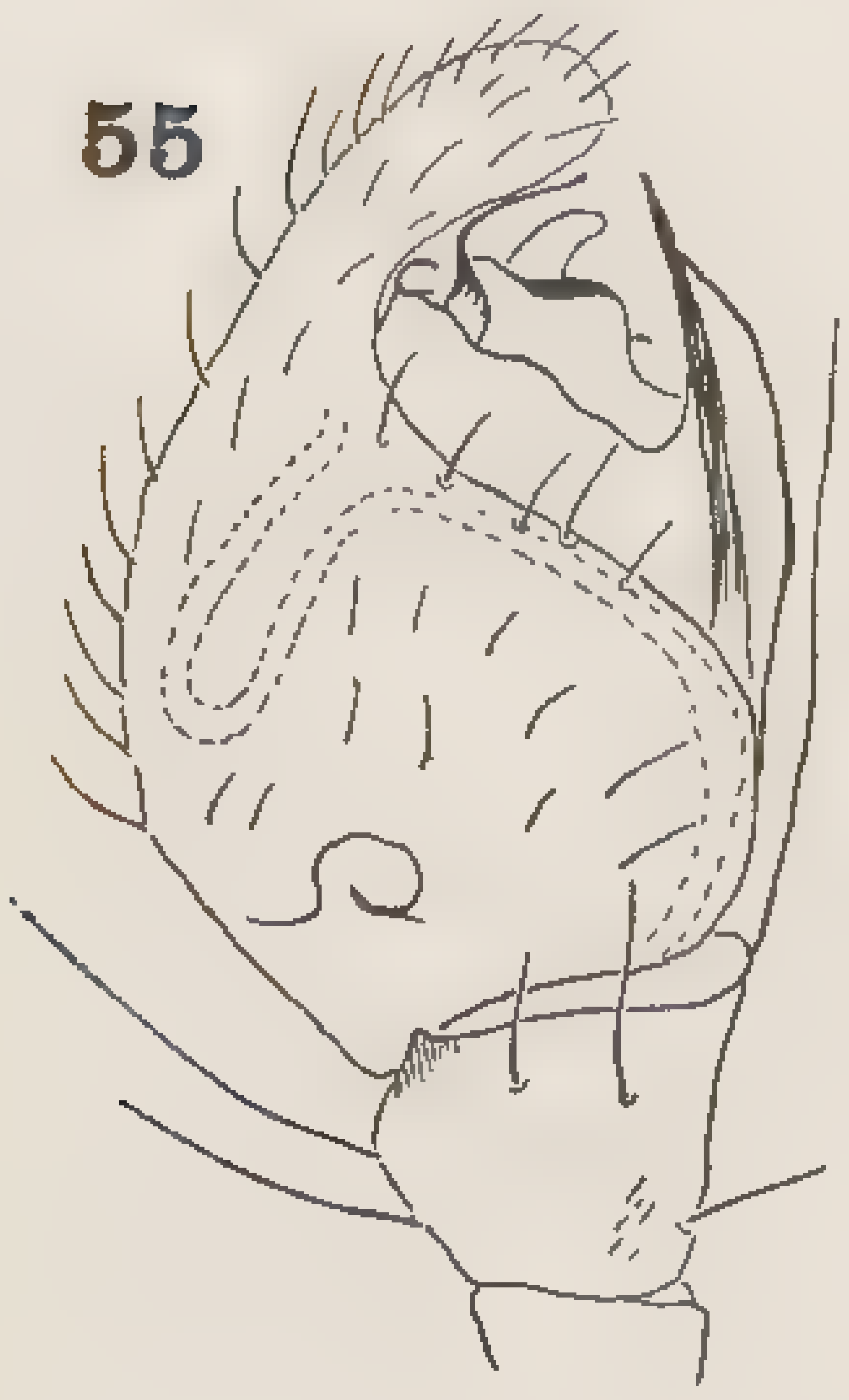
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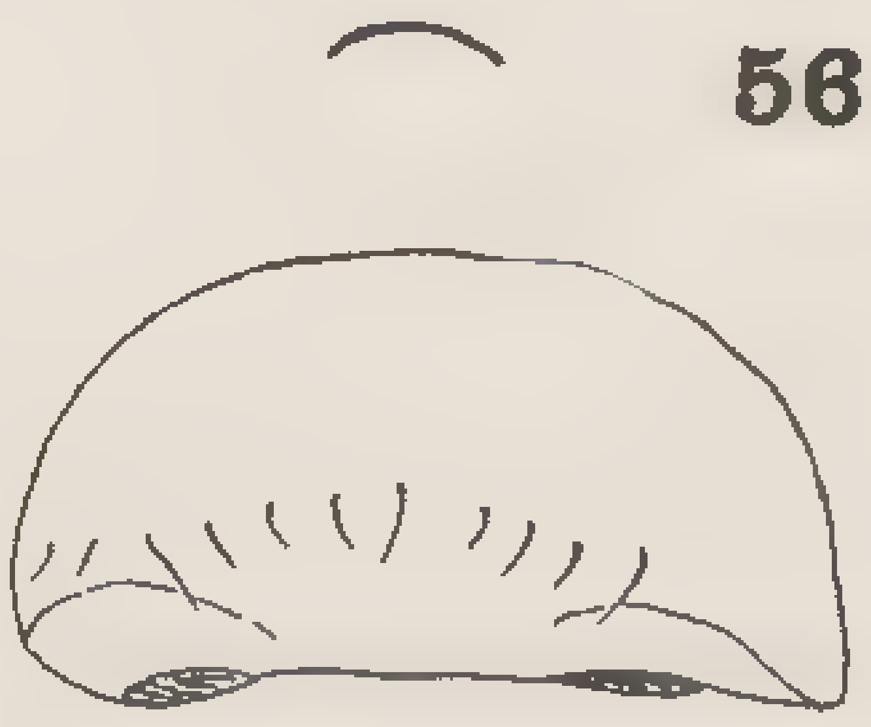
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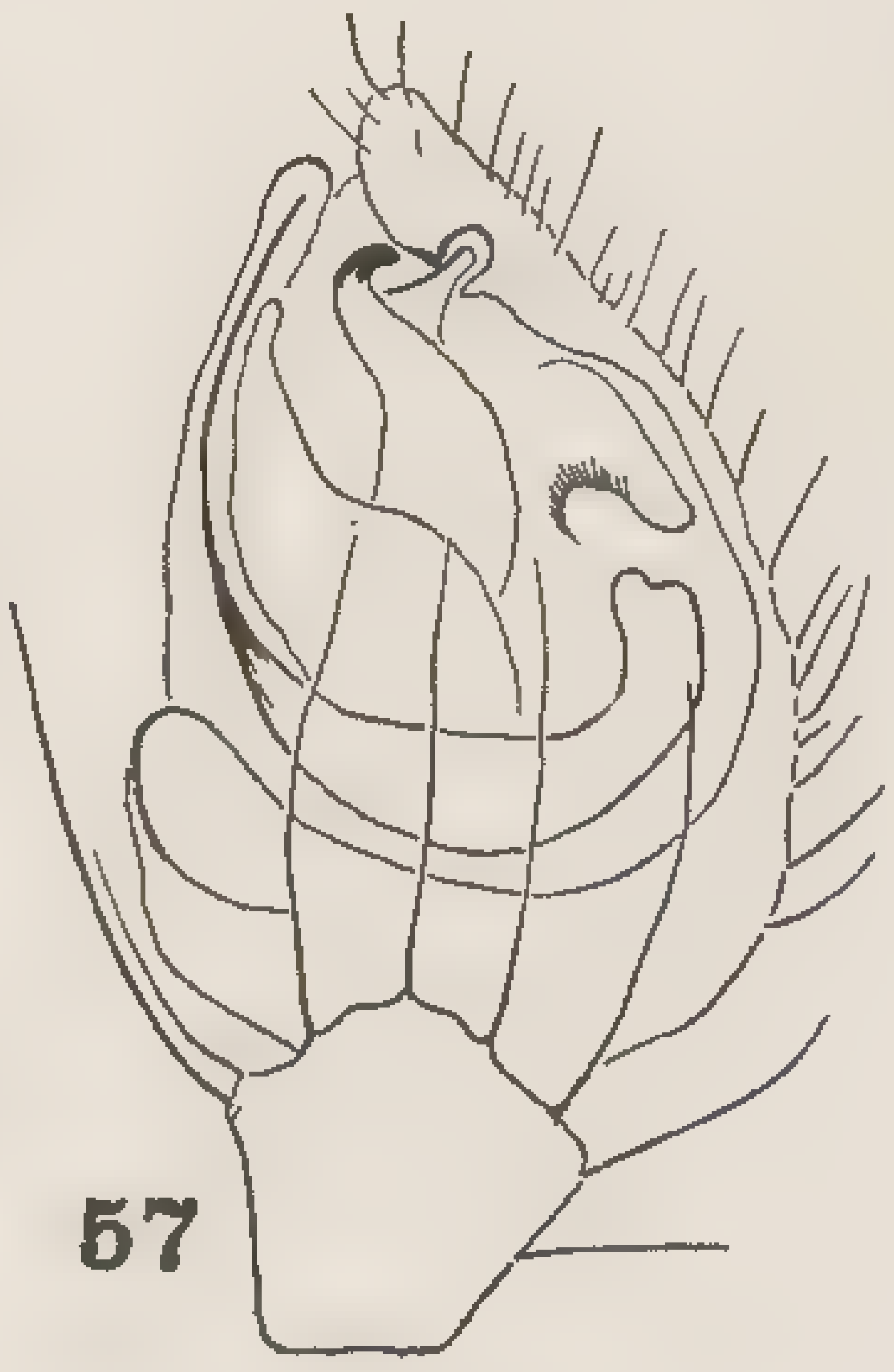
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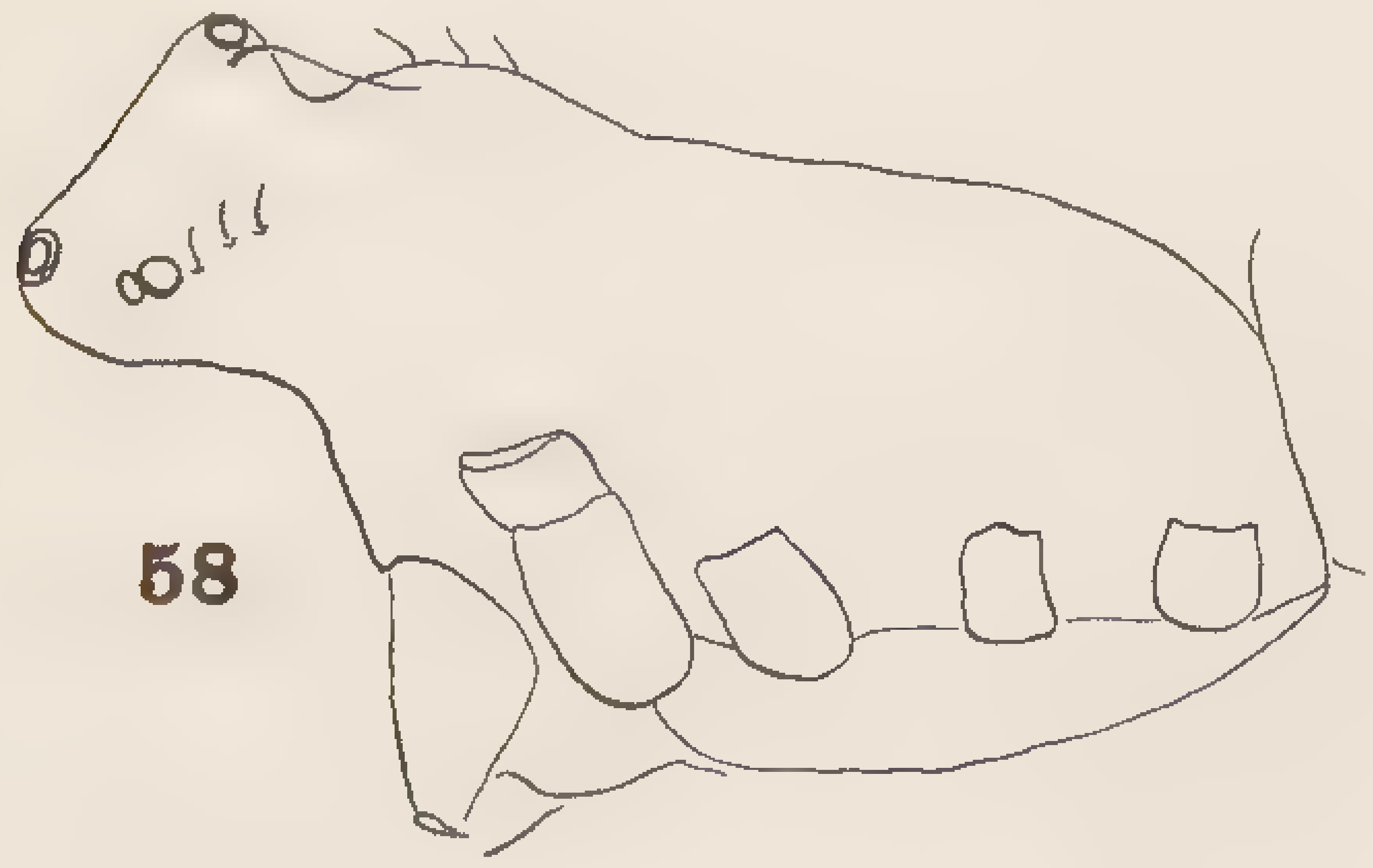
PLATE 7

PLATE 7

Fig. 58. *Thymoella banksi* spec. nov., cephalothorax of the male, lateral view.
Fig. 59. *Thymoella banksi* spec. nov., eyes of the female.
Fig. 60. *Nesticus maculatus* spec. nov., epigynum.
Fig. 61. *Dictyna guanica* Gertsch, epigynum.
Fig. 62. *Thymoella banksi* spec. nov., left palpus, retrolateral.
Fig. 63. *Nesticus maculatus* spec. nov., left palpus.
Fig. 64. *Thymoella banksi* spec. nov., epigynum.
Fig. 65. *Thymoella banksi* spec. nov., eyes of the male.
Fig. 66. *Thymoella banksi* spec. nov., left palpus, prolateral.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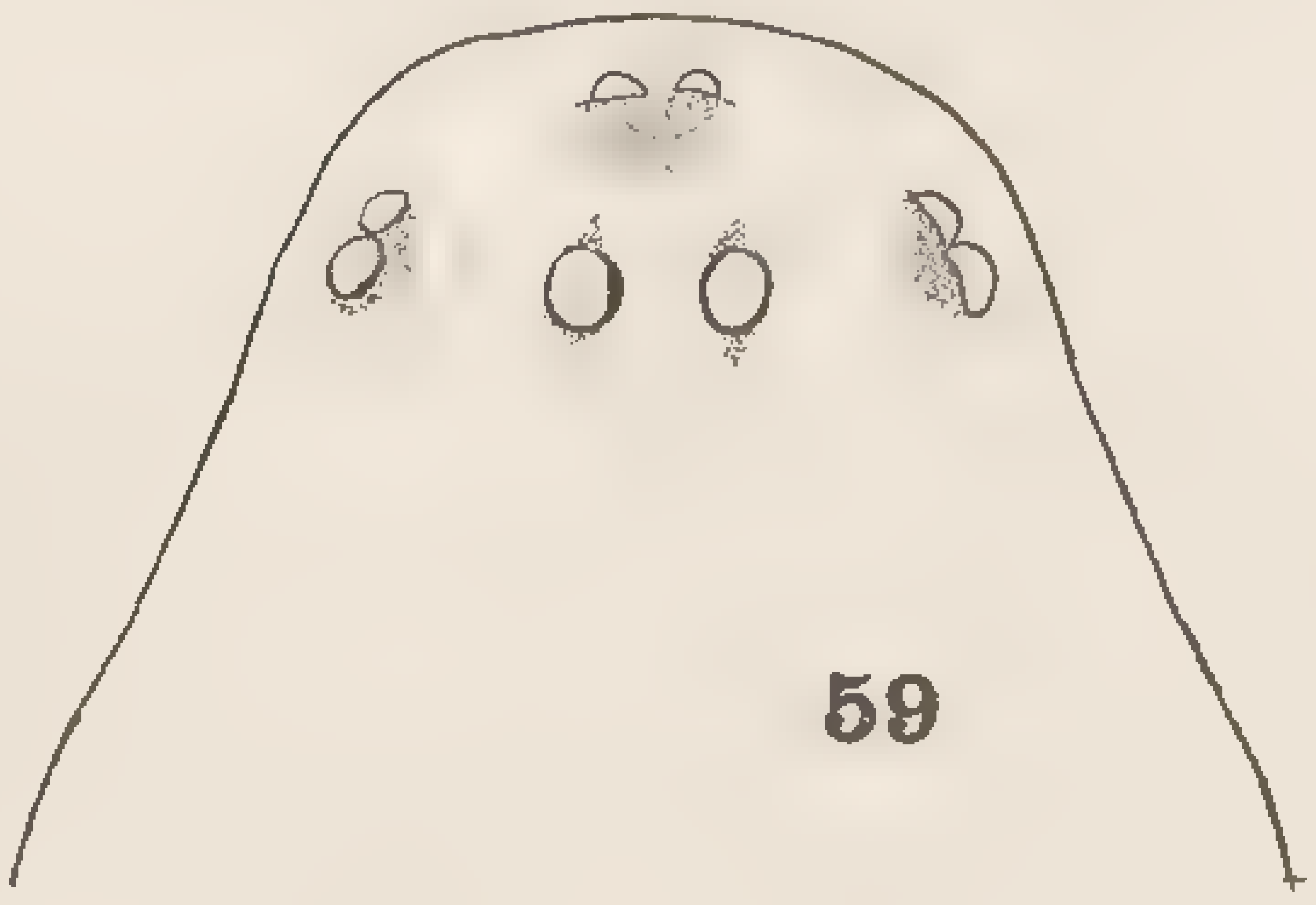
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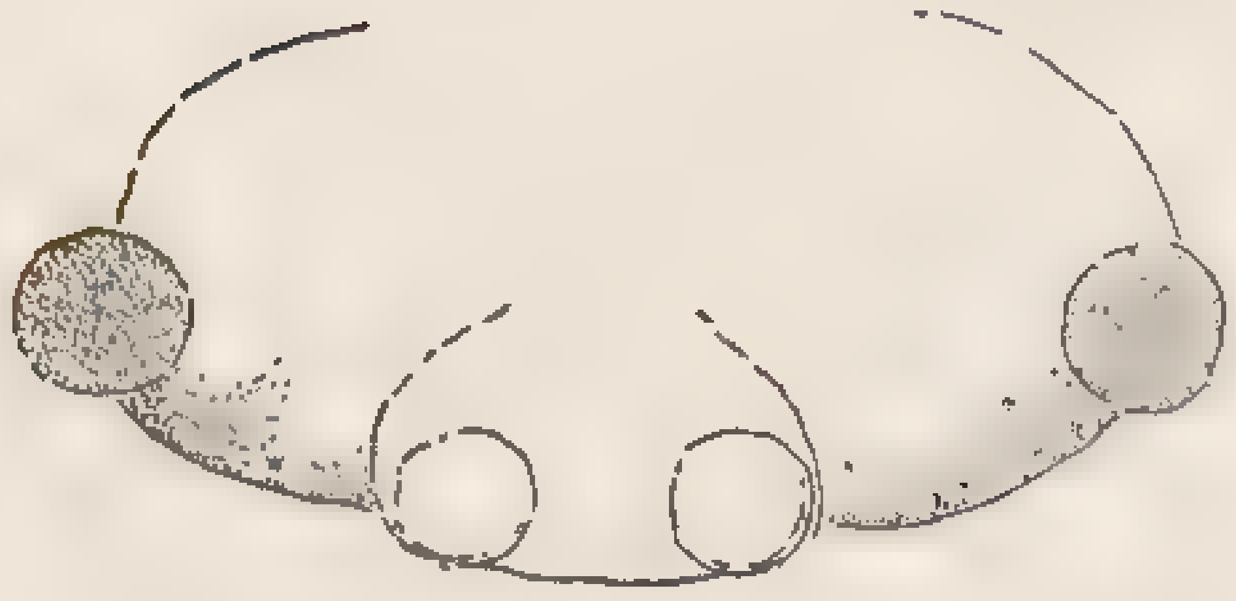
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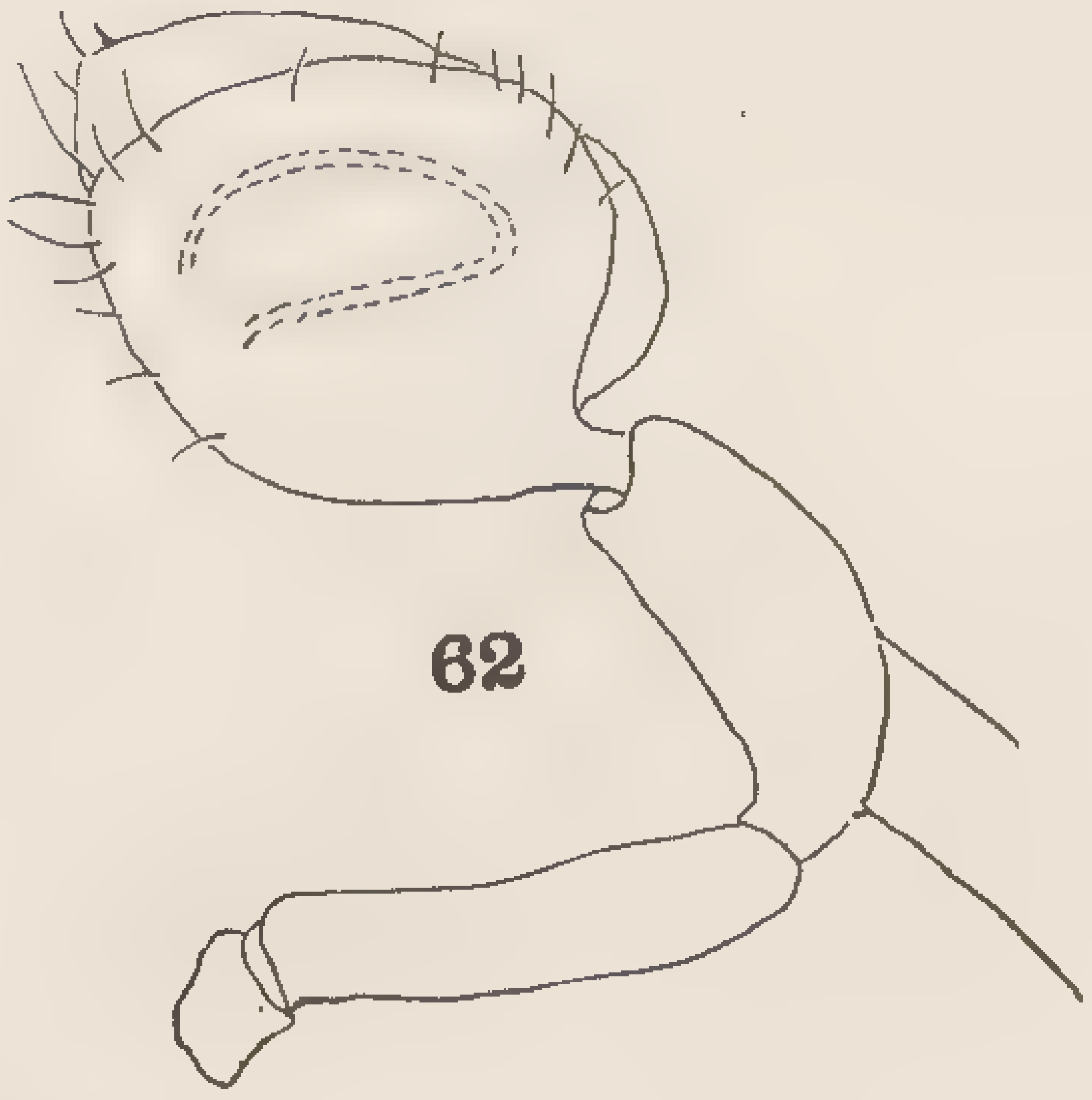
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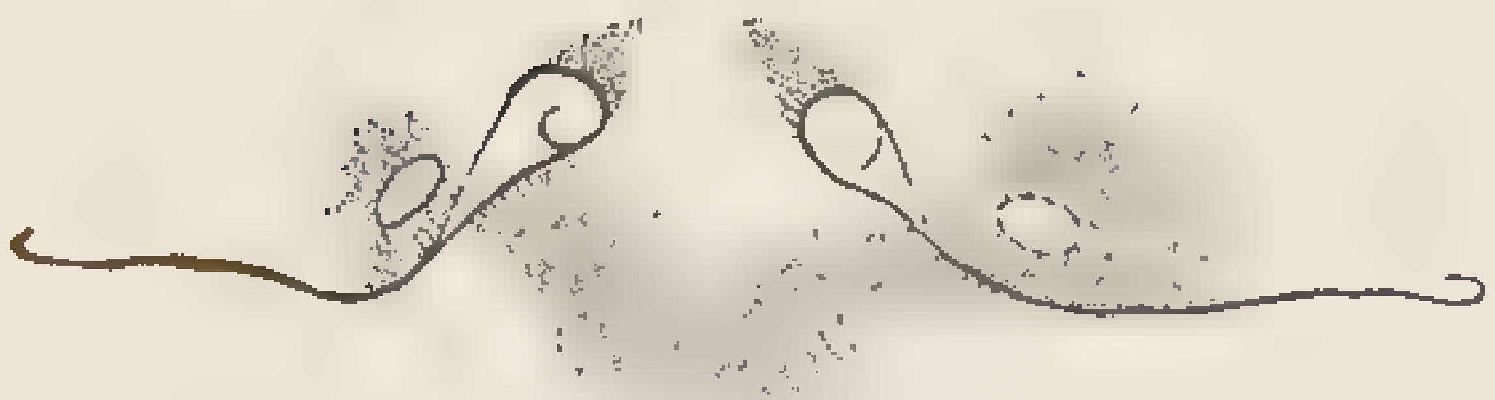
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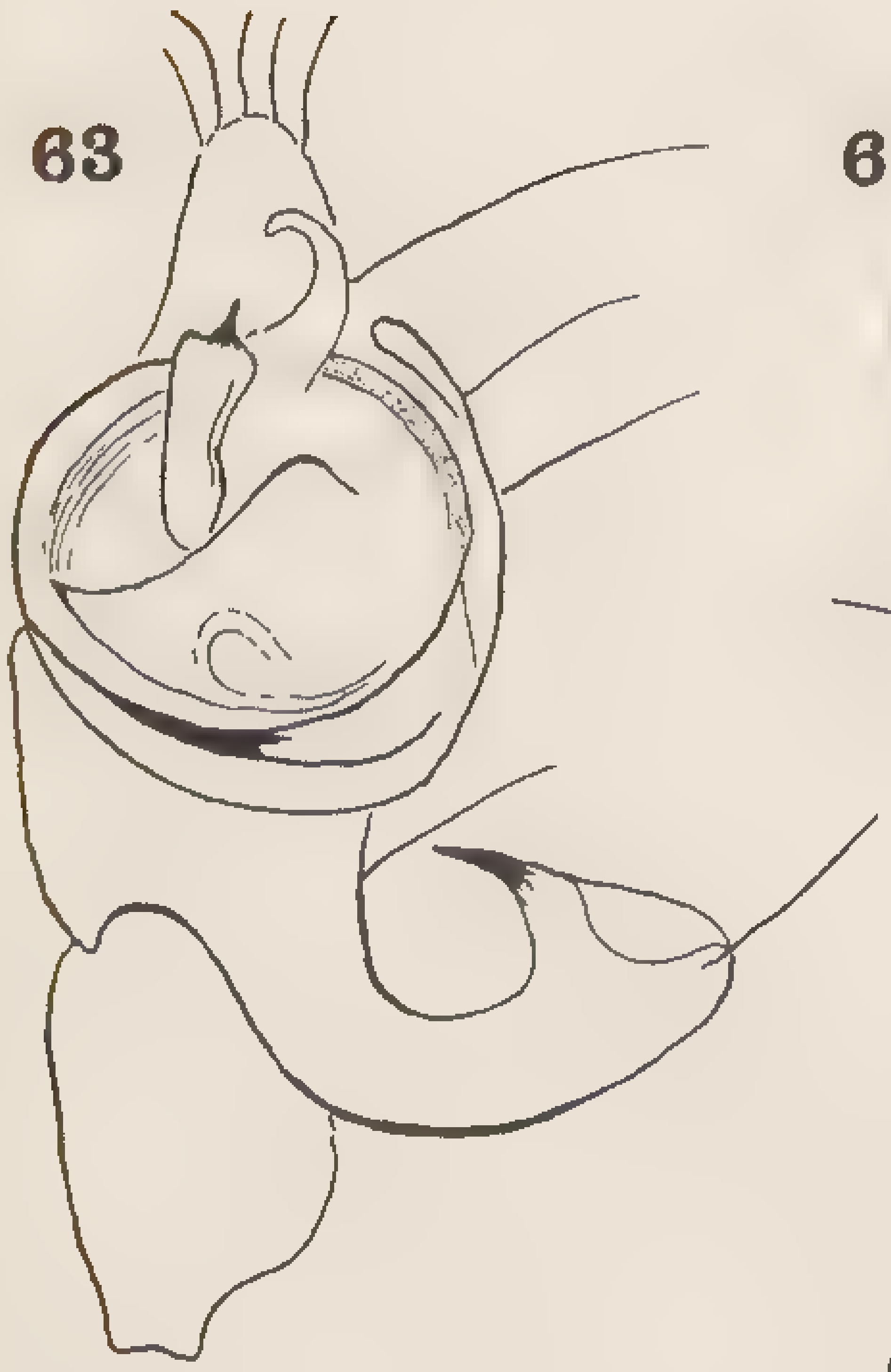
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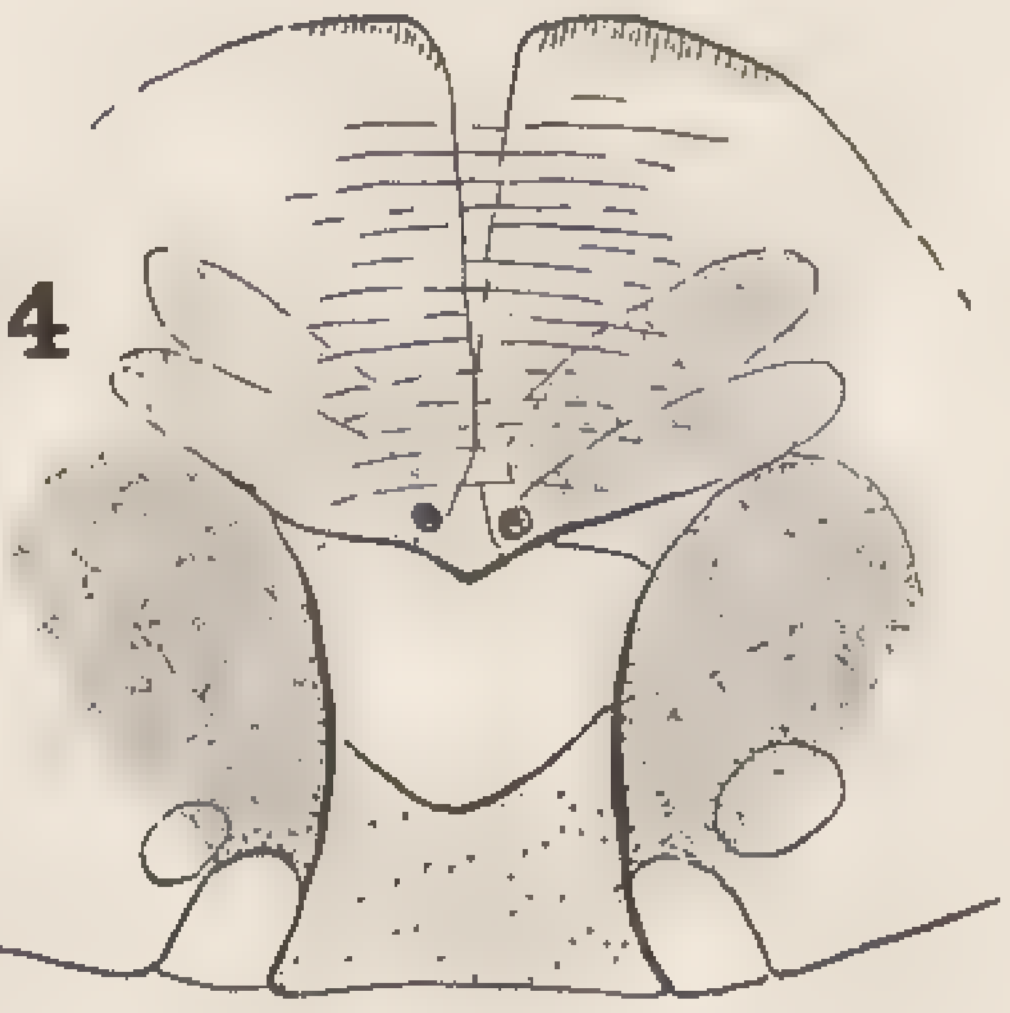
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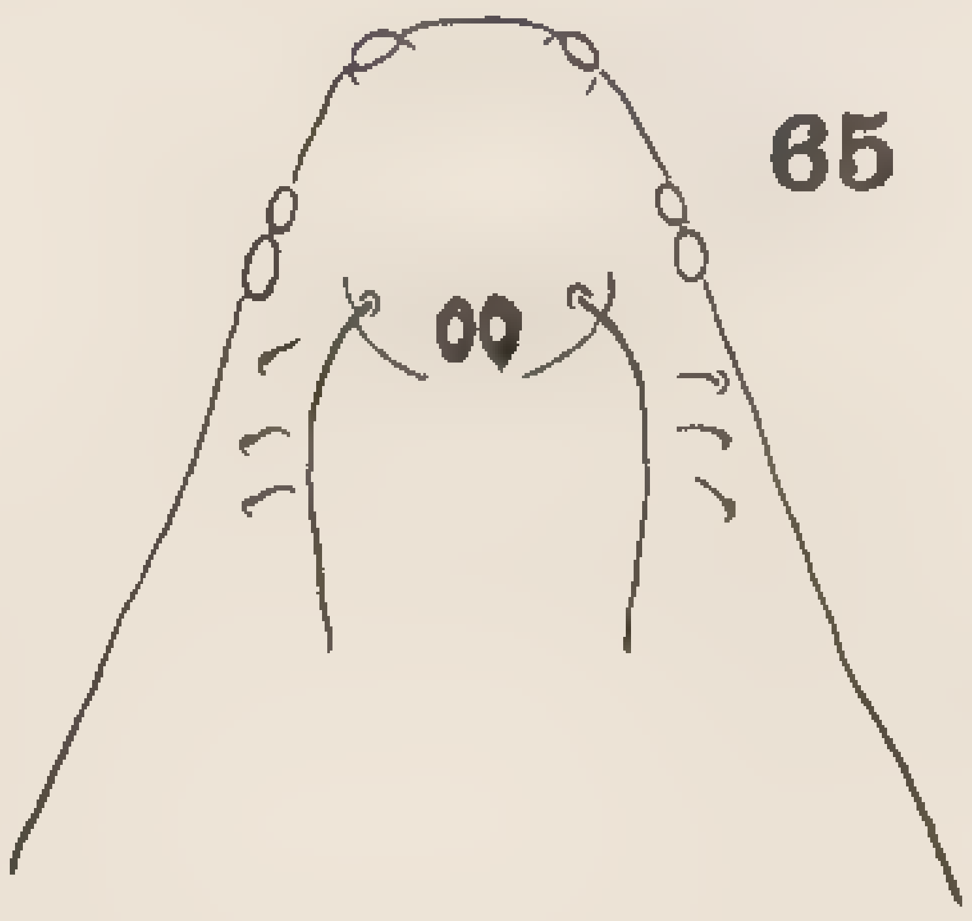
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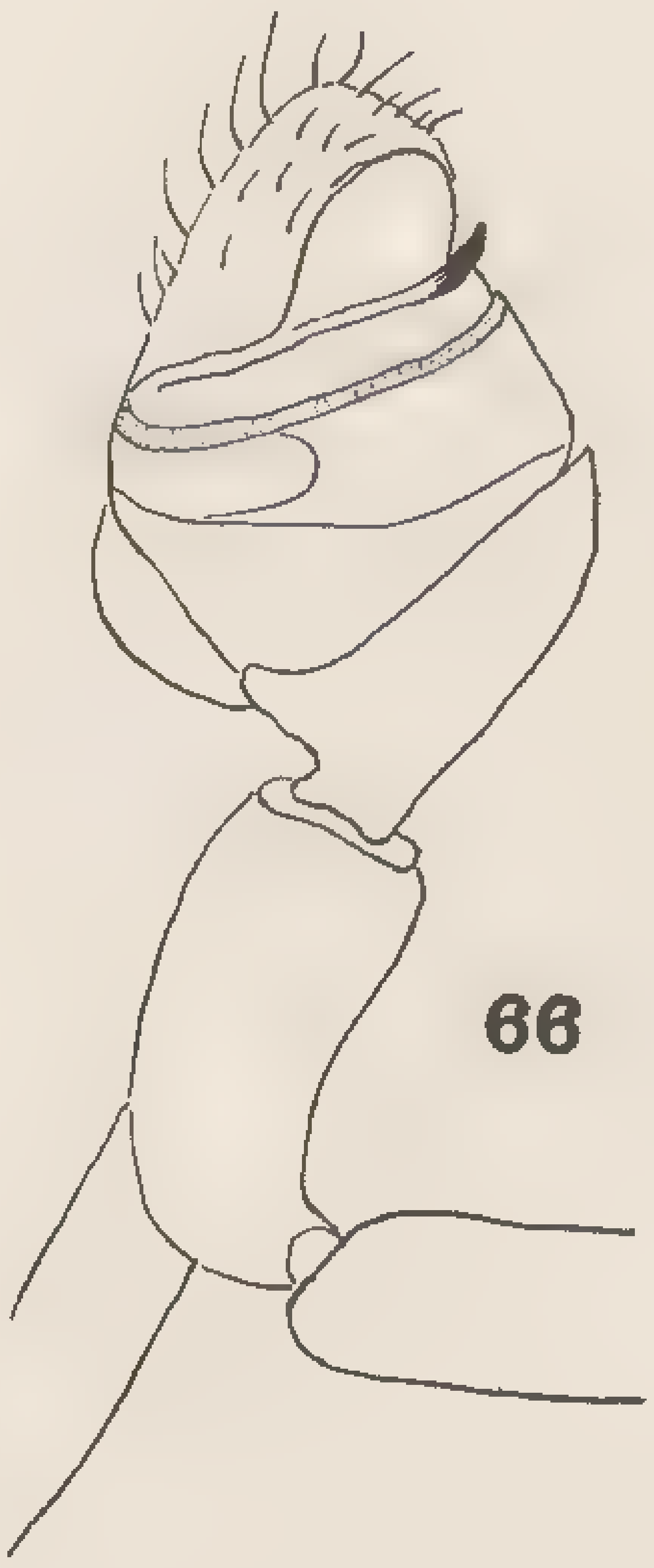
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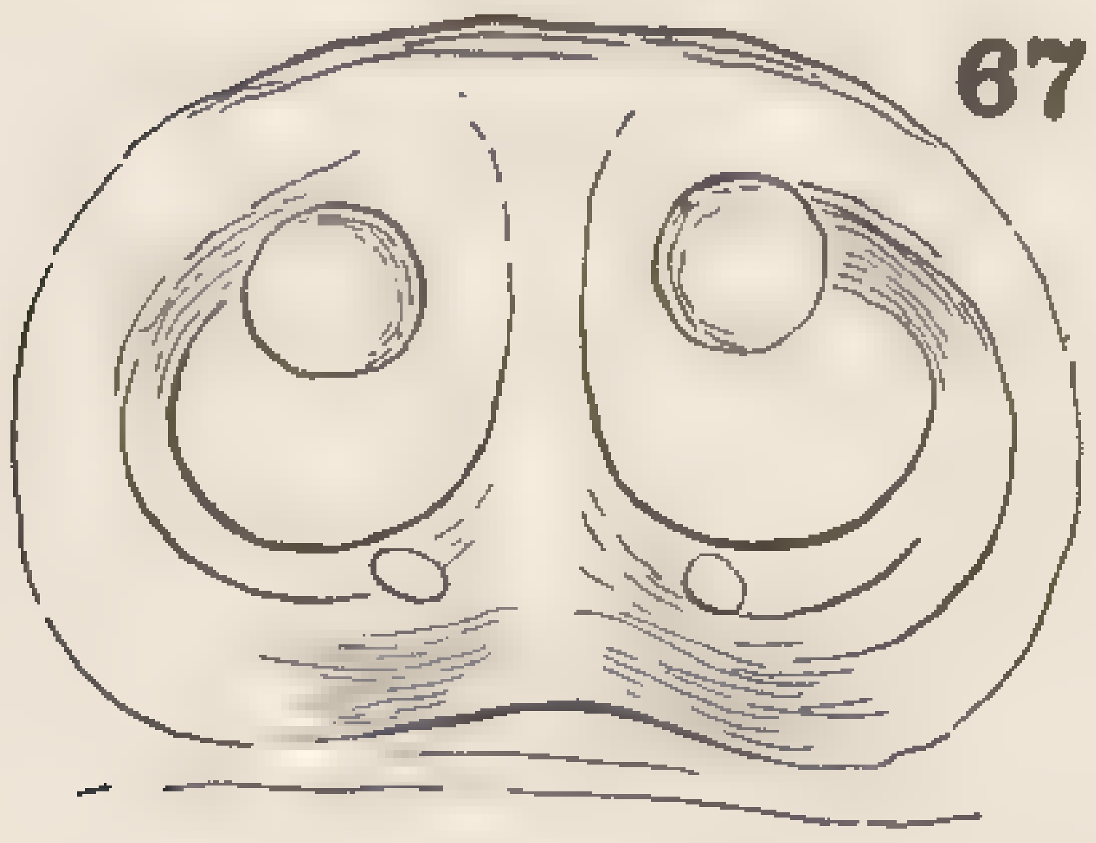
PLATE 8

PLATE 8

Fig. 67. *Frontinella bella* spec. nov., epigynum.
Fig. 68. *Ceraticelus solitarius* spec. nov., epigynum.
Fig. 69. *Eperigone antillana* spec. nov., left palpus, prolateral.
Fig. 70. *Grammonota calcarata* spec. nov., epigynum.
Fig. 71. *Ogulnius latus* spec. nov., lateral view of the female.
Fig. 72. *Eperigone antillana* spec. nov., left palpus, dorsal.
Fig. 73. *Ogulnius latus* spec. nov., dorsal view of the female.
Fig. 74. *Eperigone antillana* spec. nov., epigynum.
Fig. 75. *Lomaita darlingtoni* spec. nov., right palpus, retrolateral.
Fig. 76. *Lomaita darlingtoni* spec. nov., right palpus, prolateral.
Fig. 77. *Lomaita darlingtoni* spec. nov., eyes of the male.
Fig. 78. *Grammonota calcarata* spec. nov., left palpus.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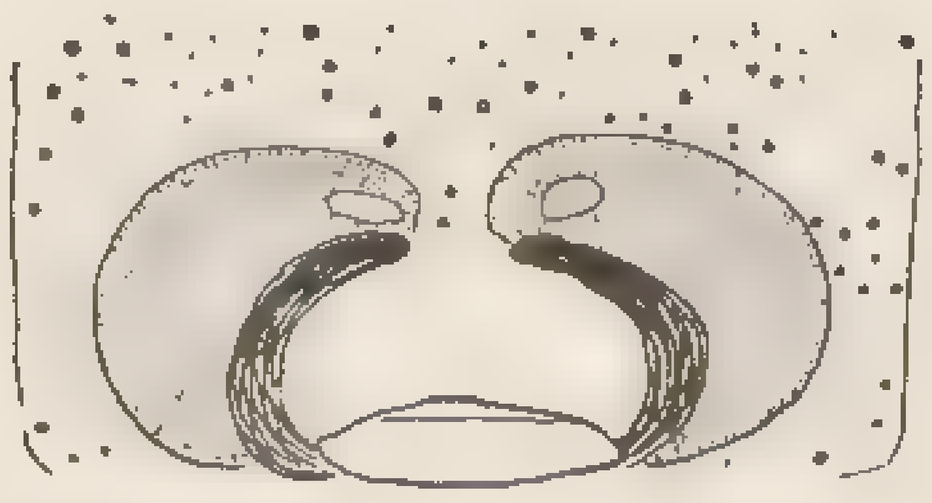
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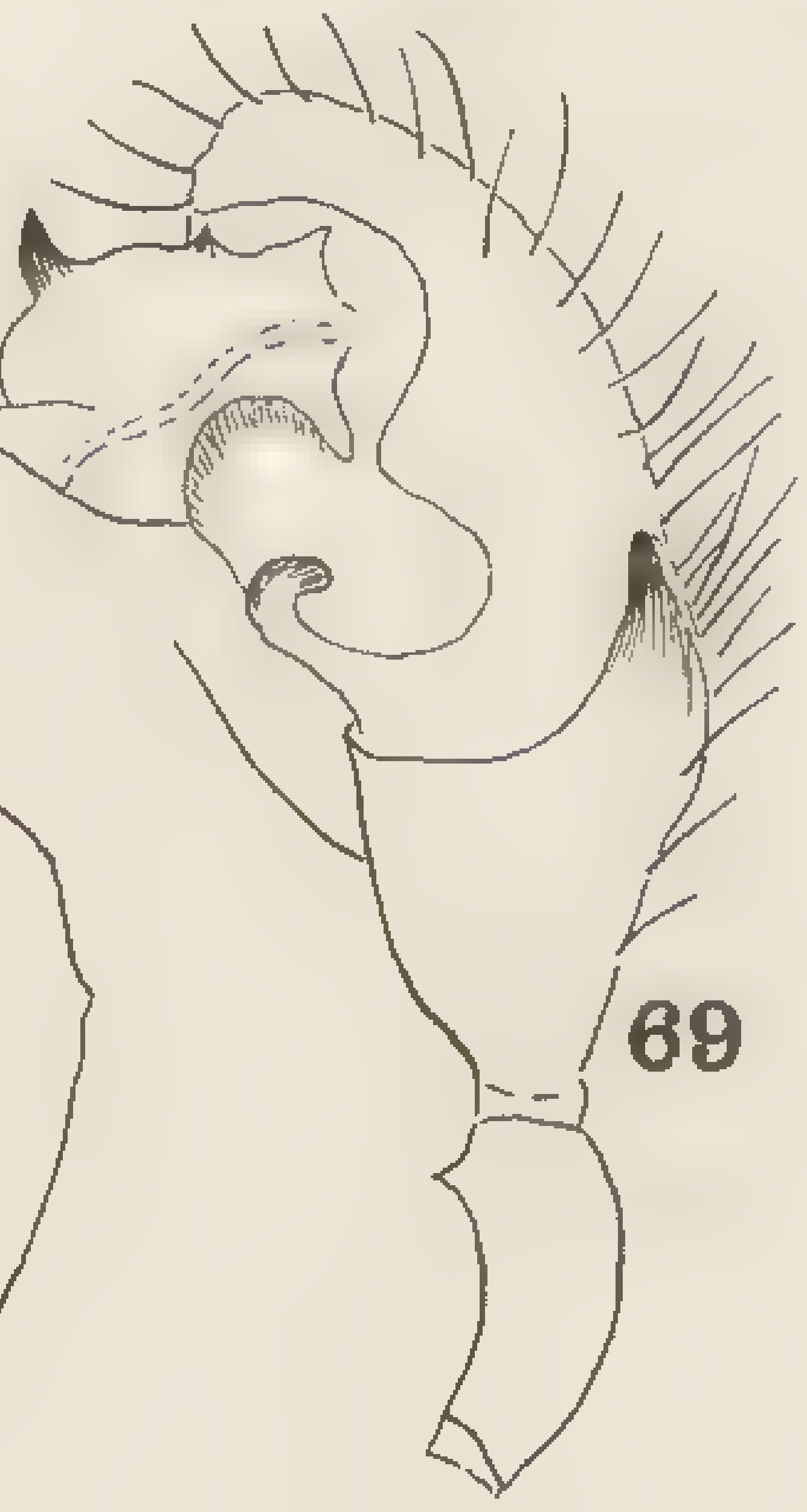
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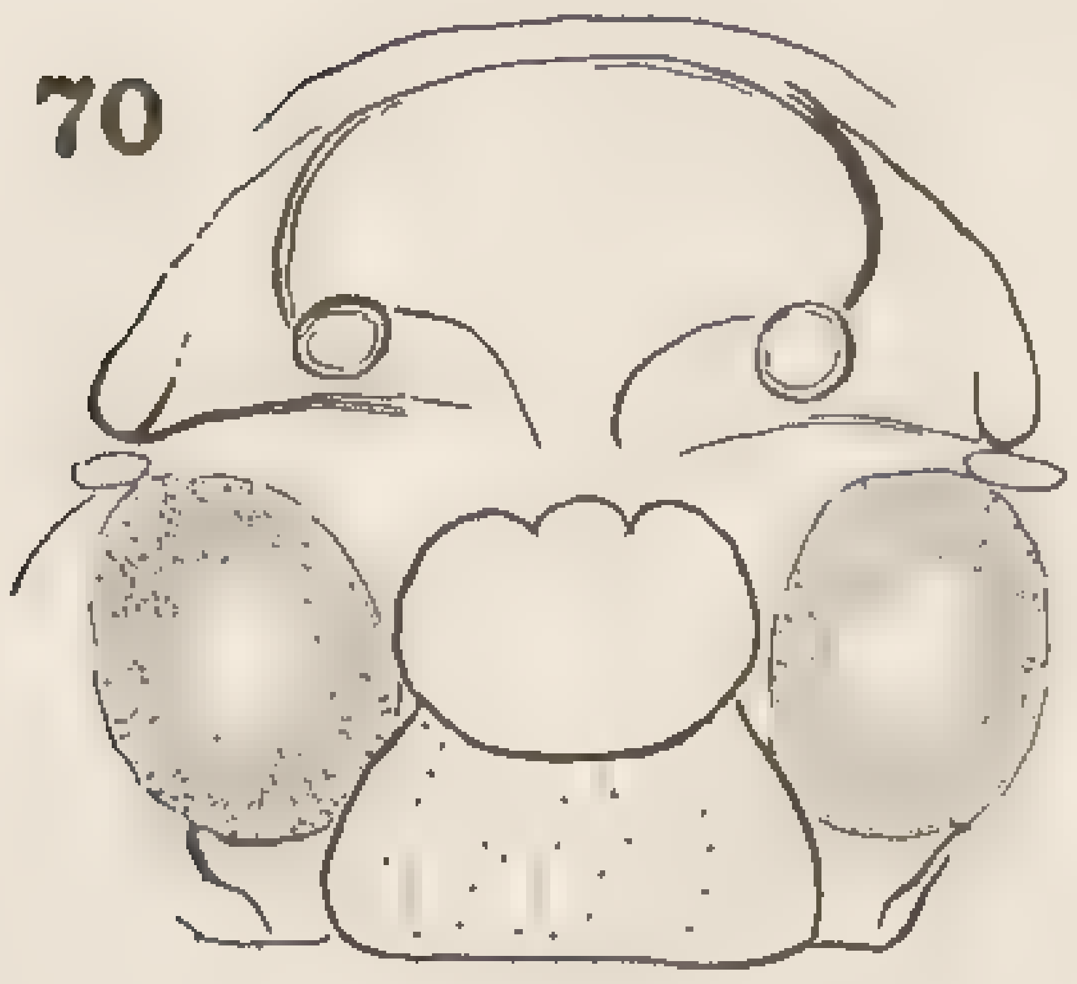
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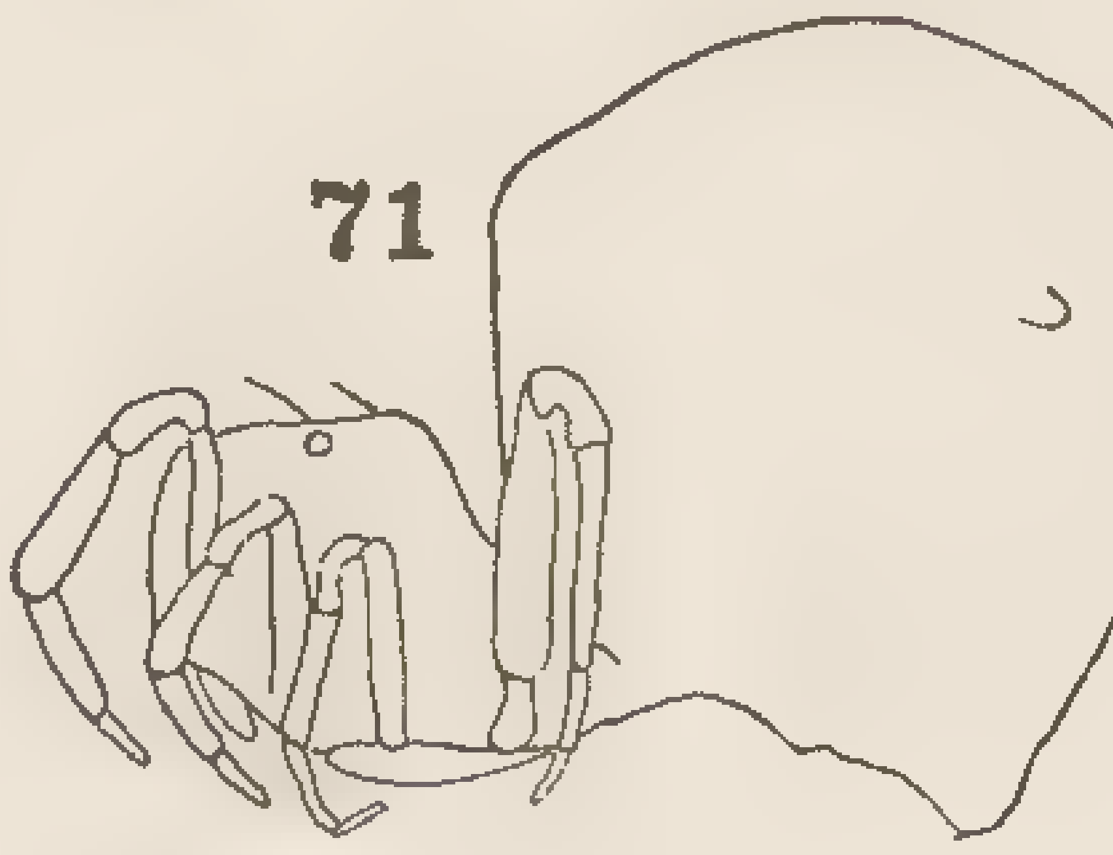
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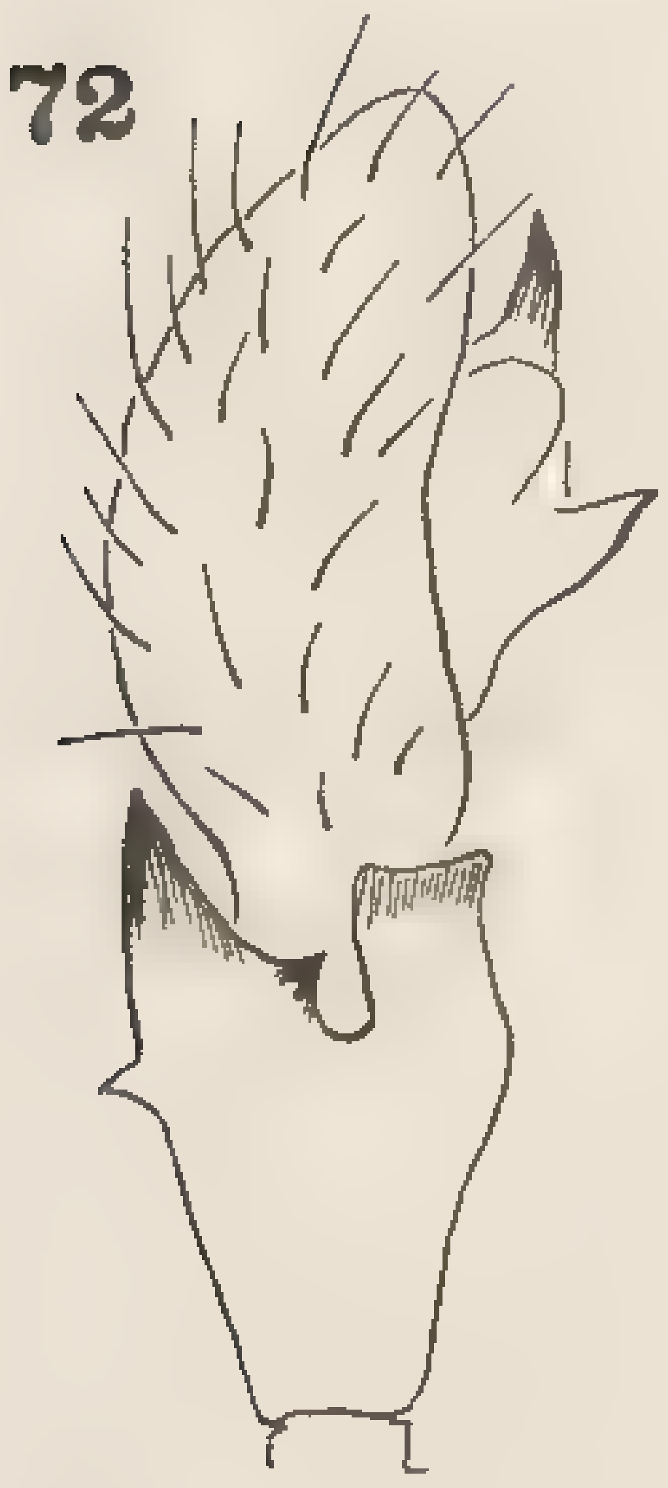
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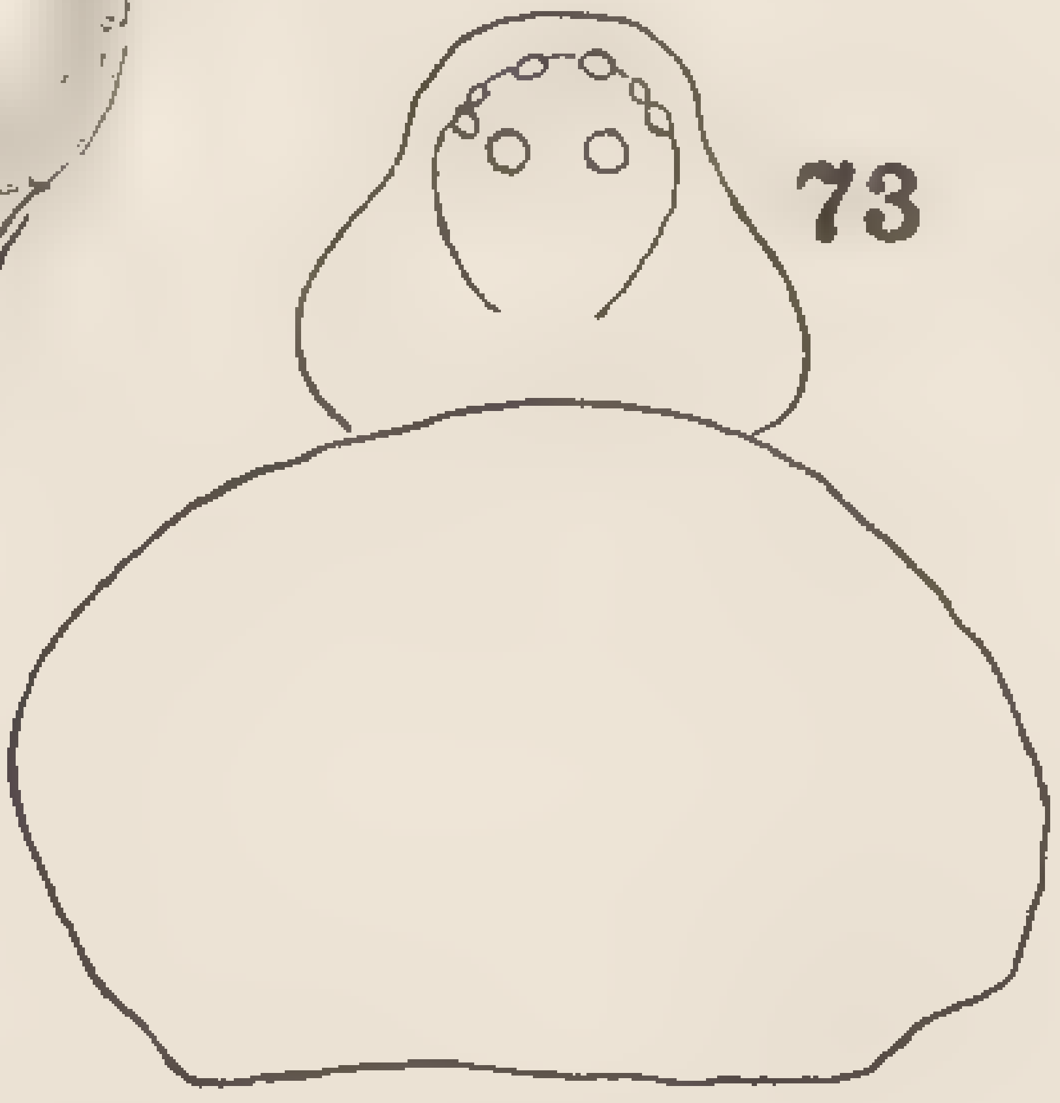
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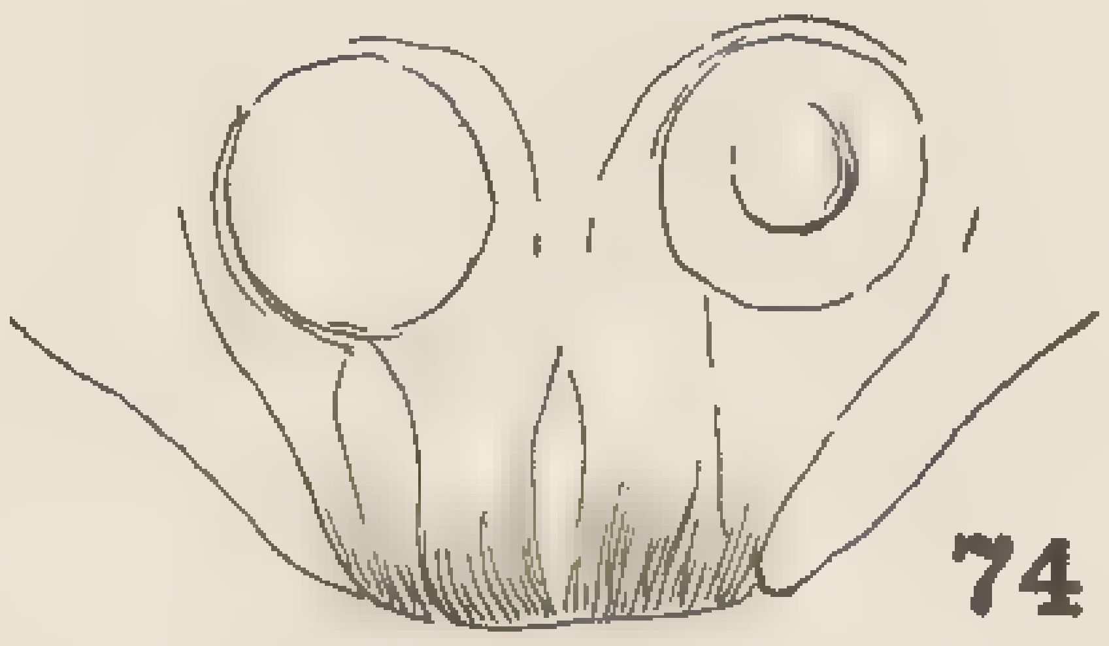
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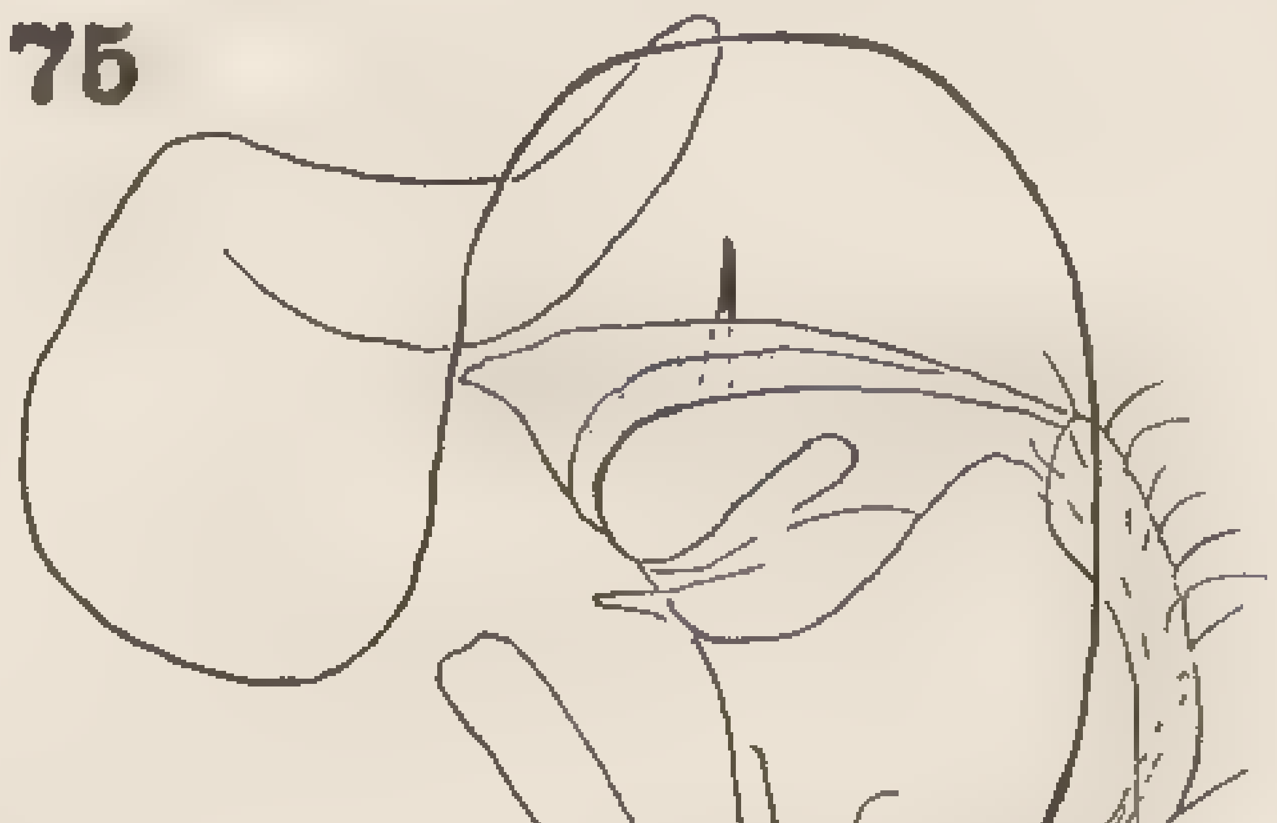
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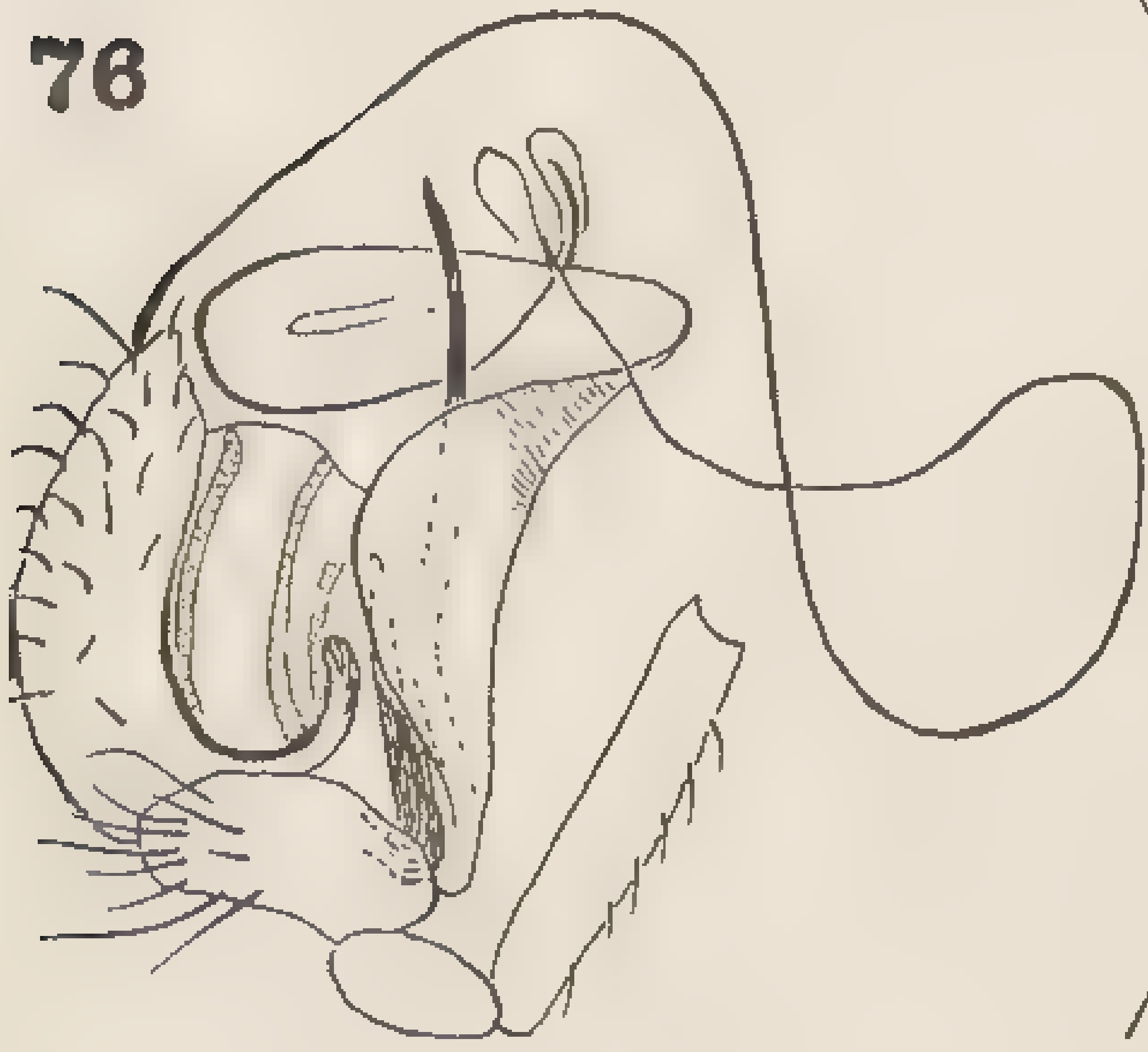
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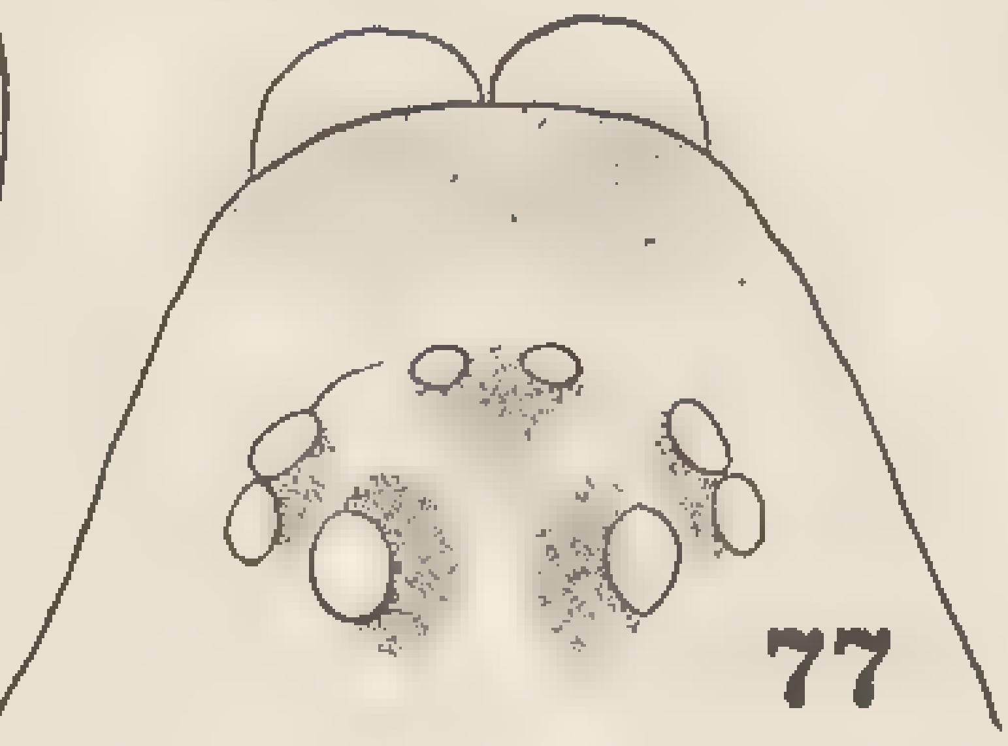
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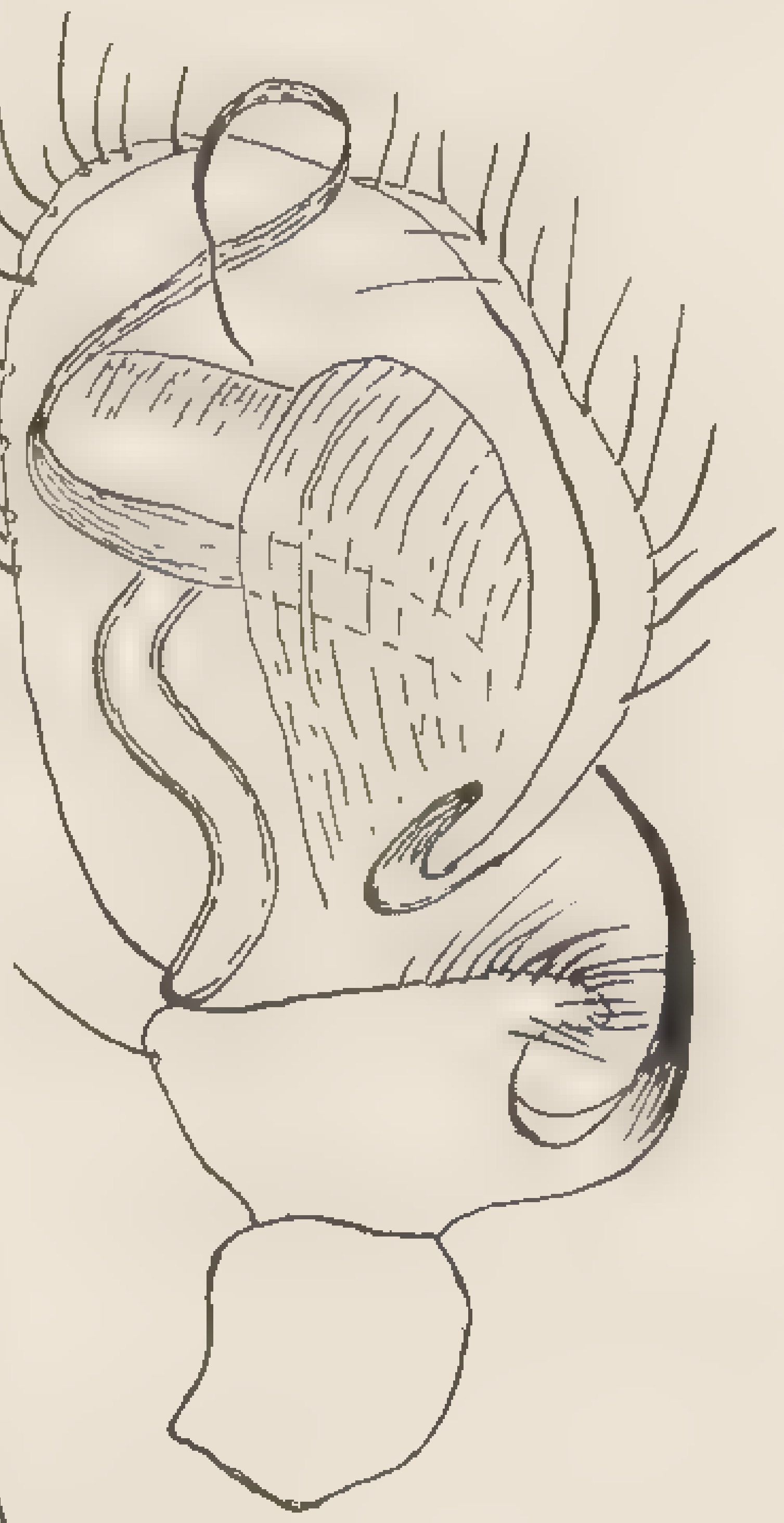
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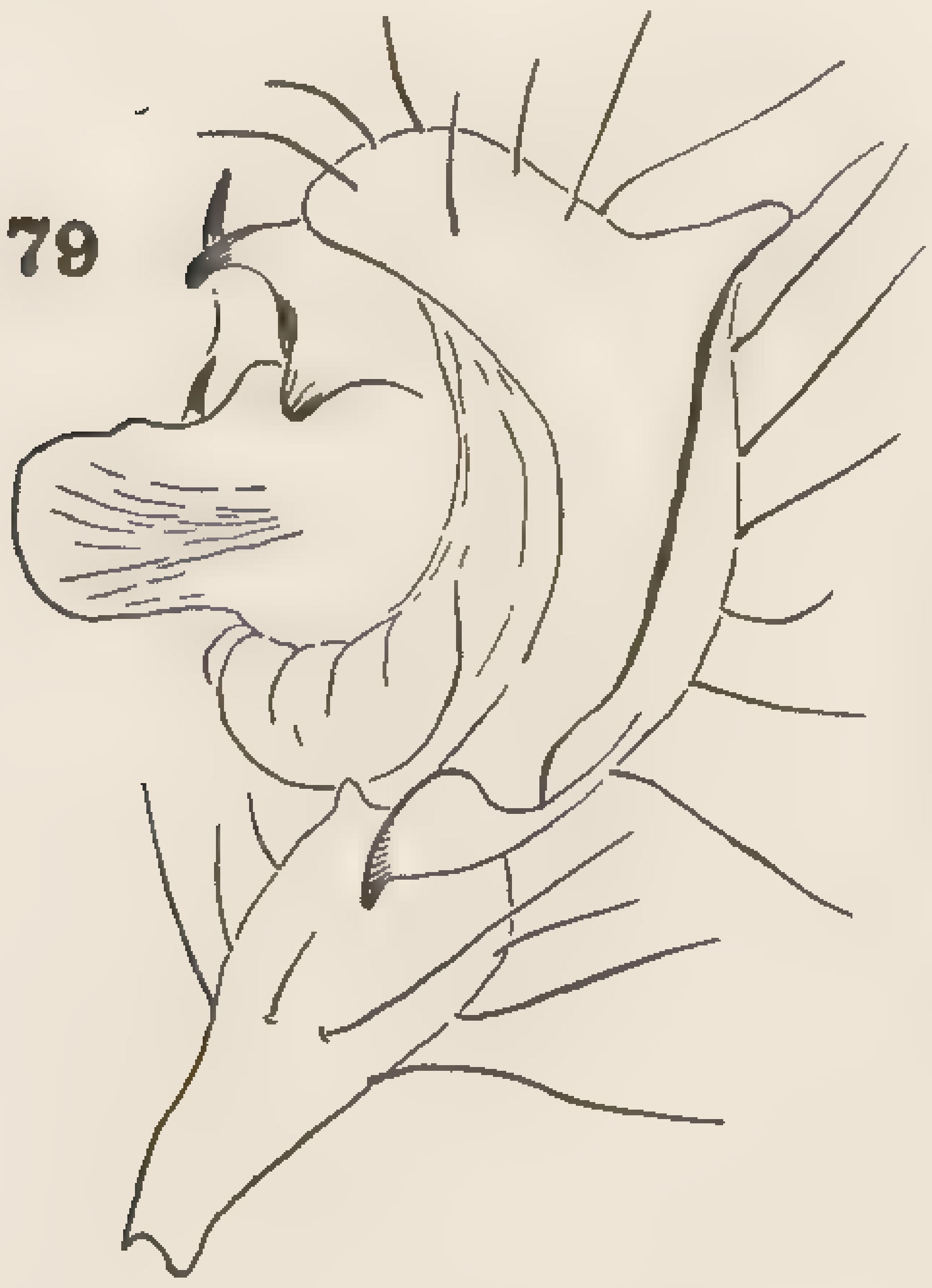
PLATE 9

PLATE 9

Fig. 79. *Mimetus hispaniolae* spec. nov., left palpus.
Fig. 80. *Mimetus hispaniolae* spec. nov., eyes of the male.
Fig. 81. *Ctenus hiemalis* spec. nov., epigynum.
Fig. 82. *Ctenus monticolus* spec. nov., epigynum.
Fig. 83. *Ctenus manni* spec. nov., epigynum.
Fig. 84. *Trujillina spinipes* spec. nov., epigynum.
Fig. 85. *Trujillina spinipes* spec. nov., eyes of the female.
Fig. 86. *Ctenus darlingtoni* spec. nov., epigynum.
Fig. 87. *Odo hursti* spec. nov., left palpus.
Fig. 88. *Ctenus insulanus* spec. nov., left palpus, retrolateral.
Fig. 89. *Ctenus avidus* spec. nov., epigynum.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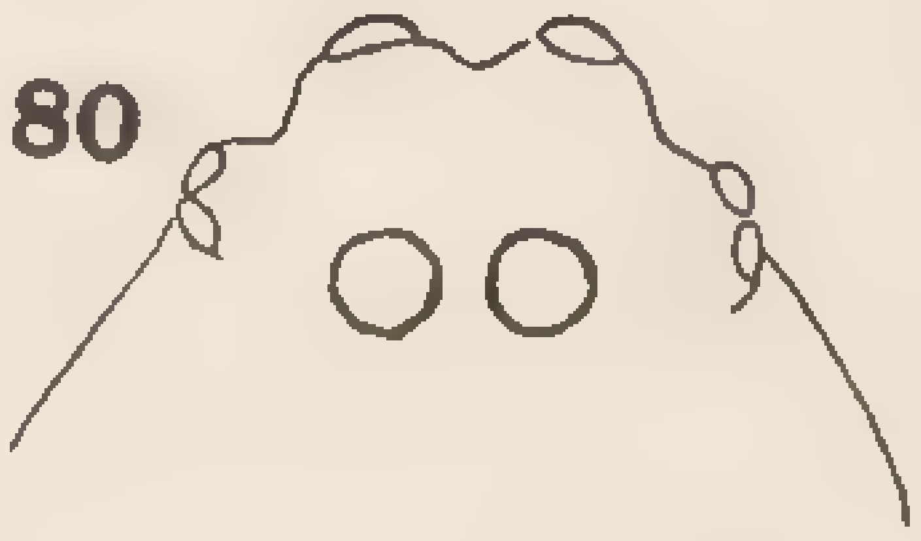
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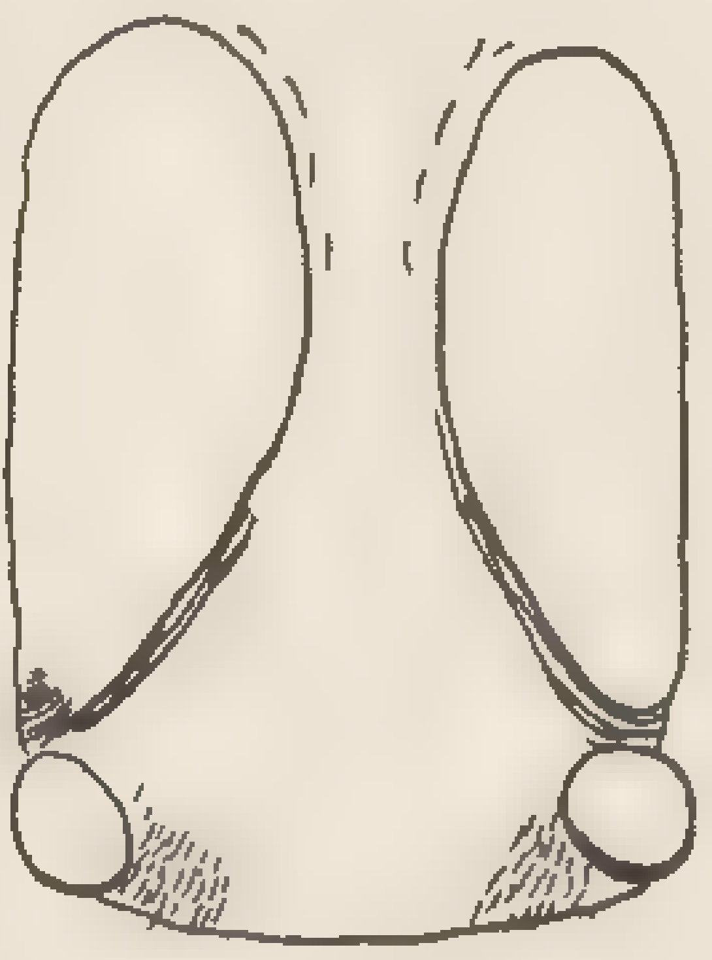
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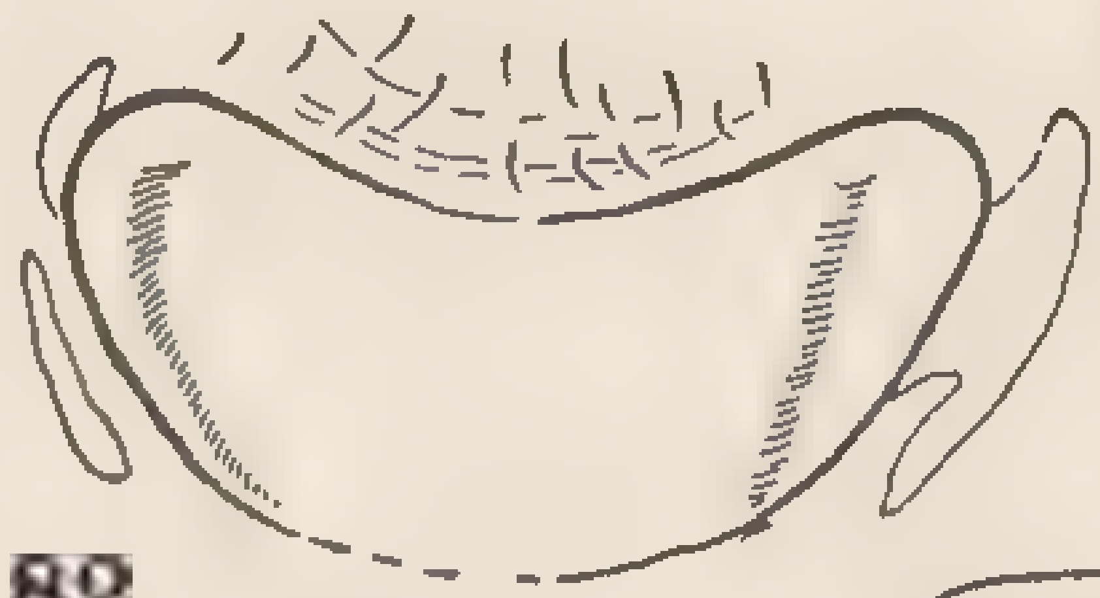
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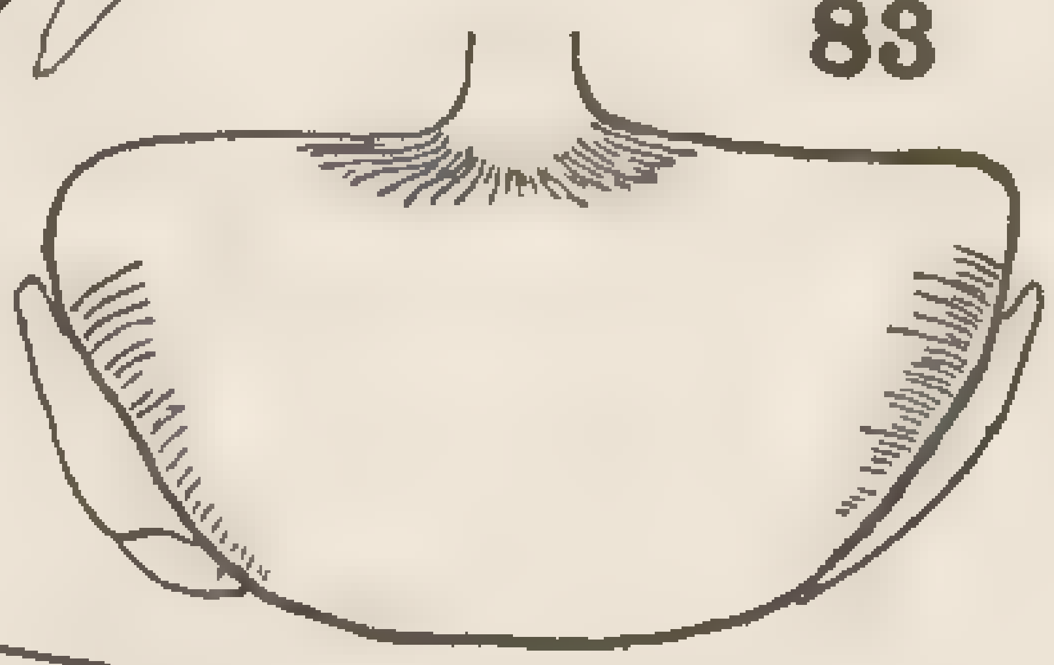
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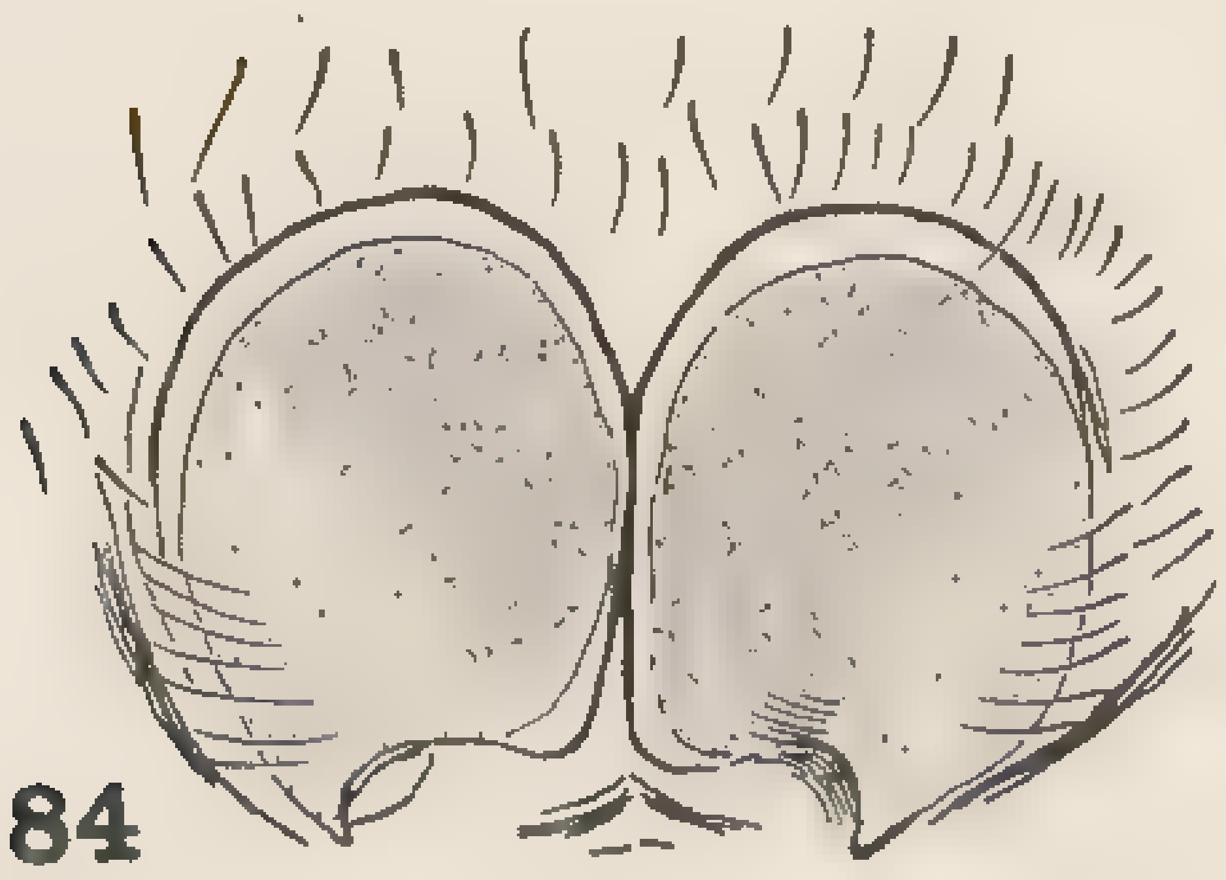
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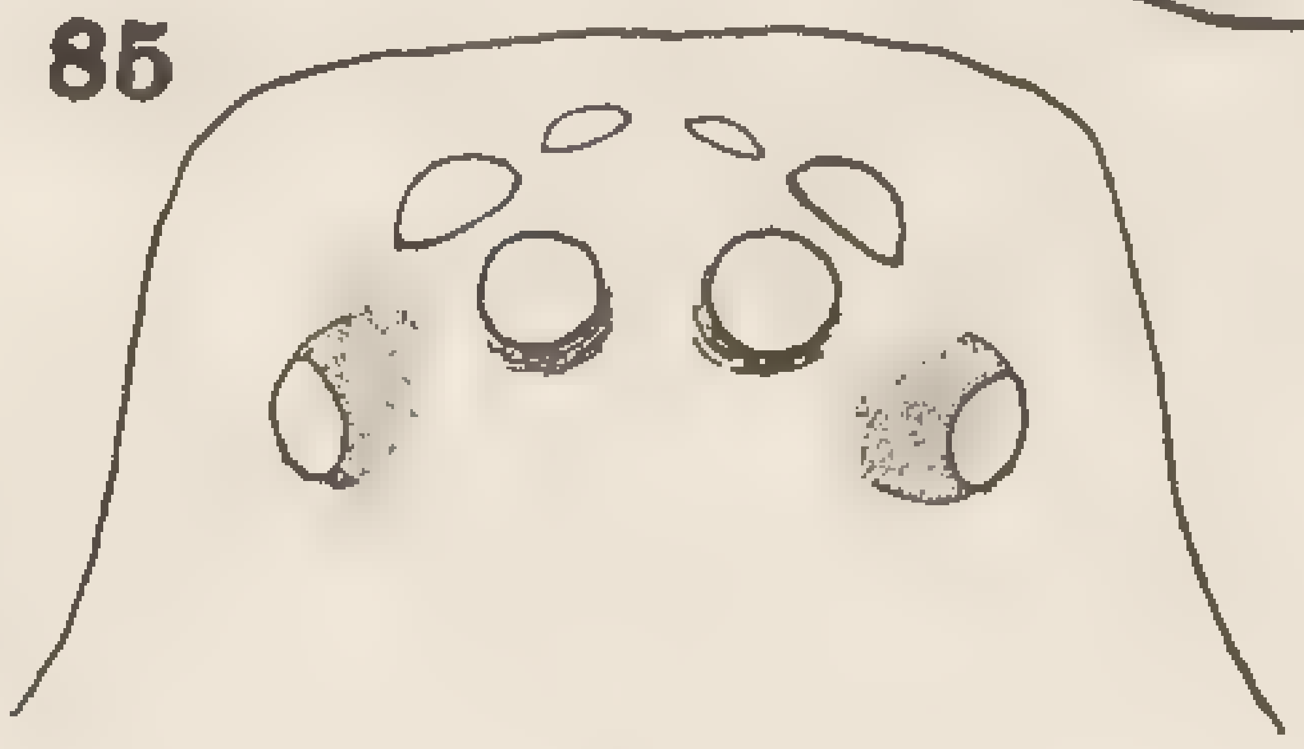
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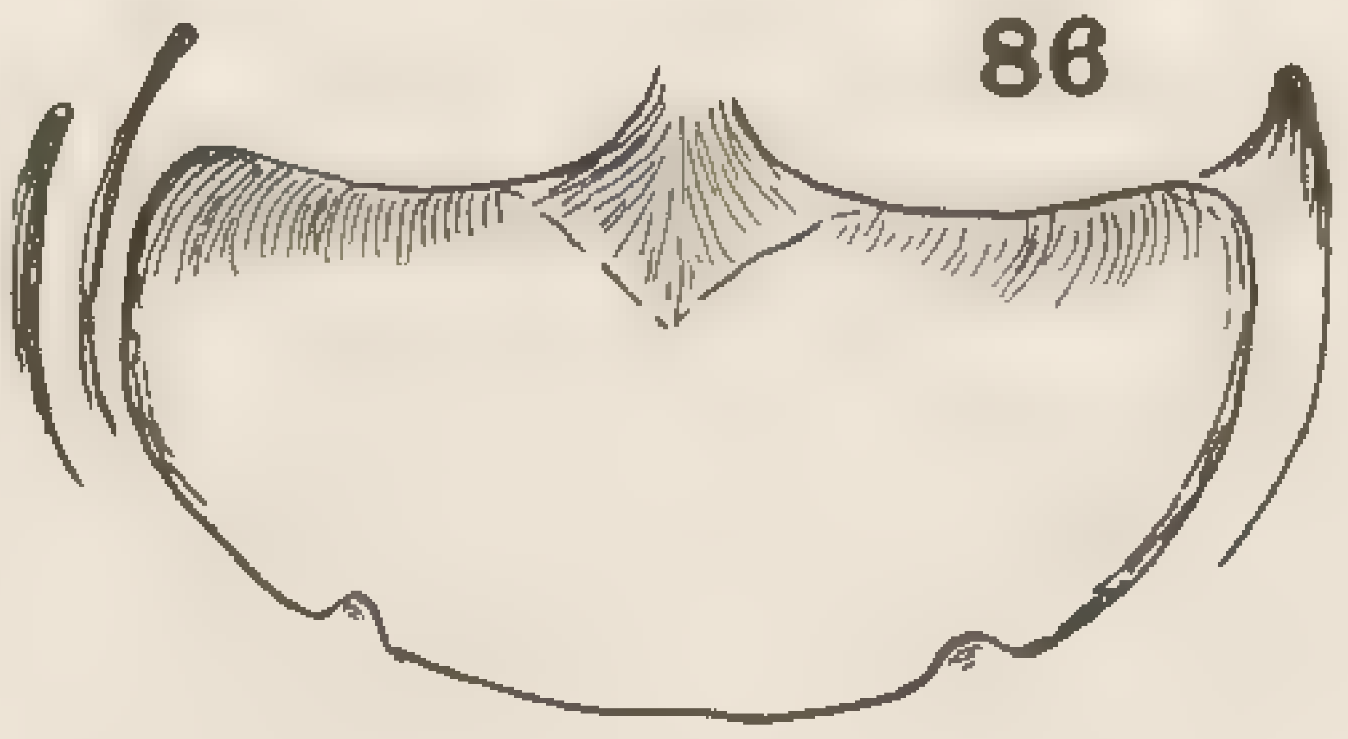
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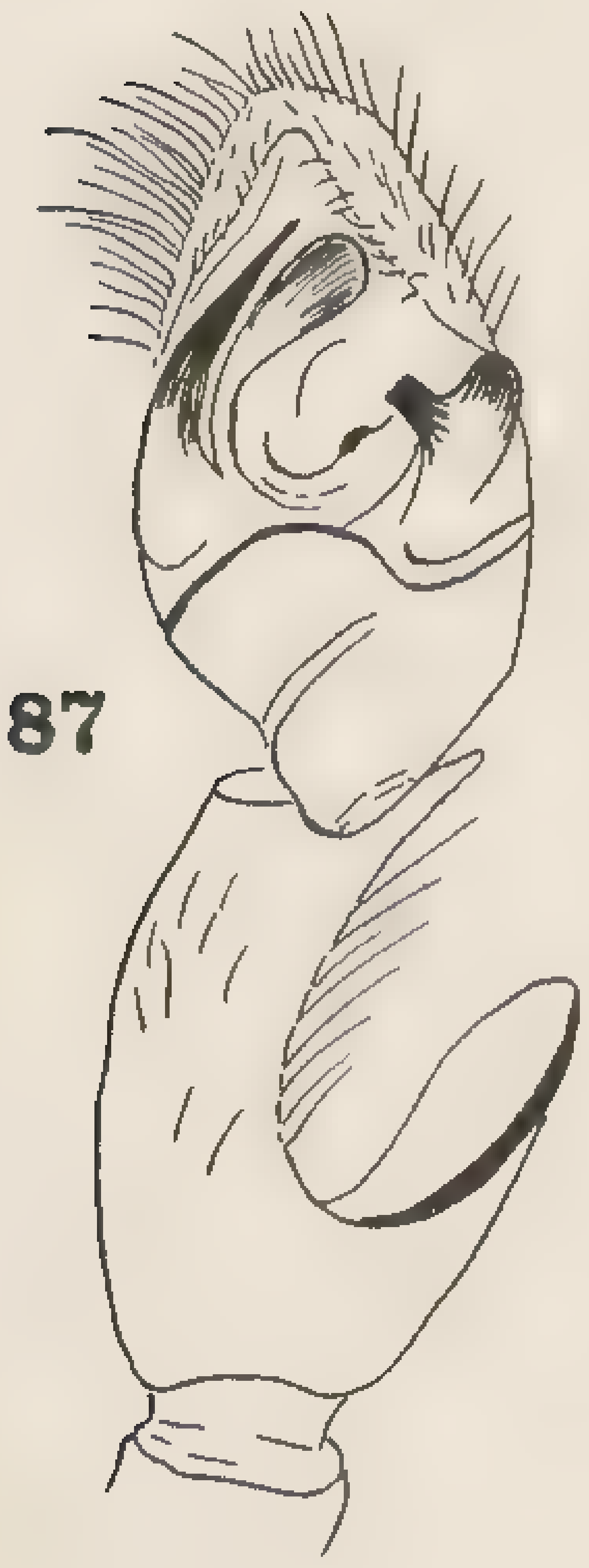
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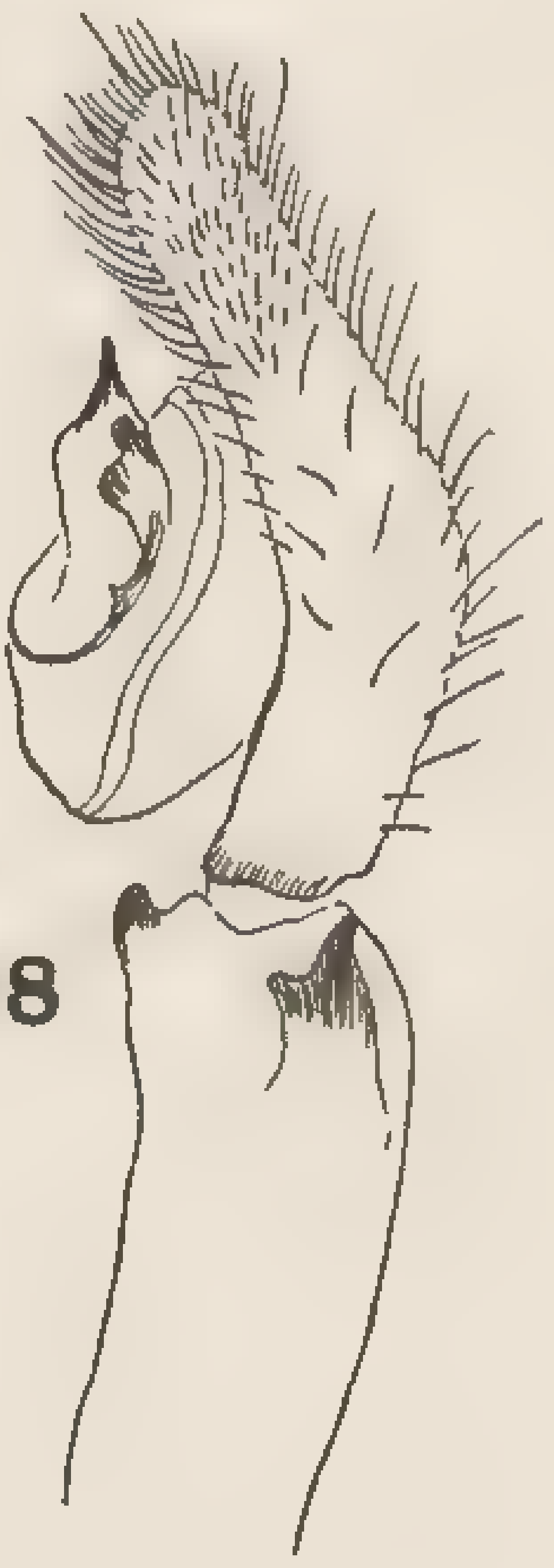
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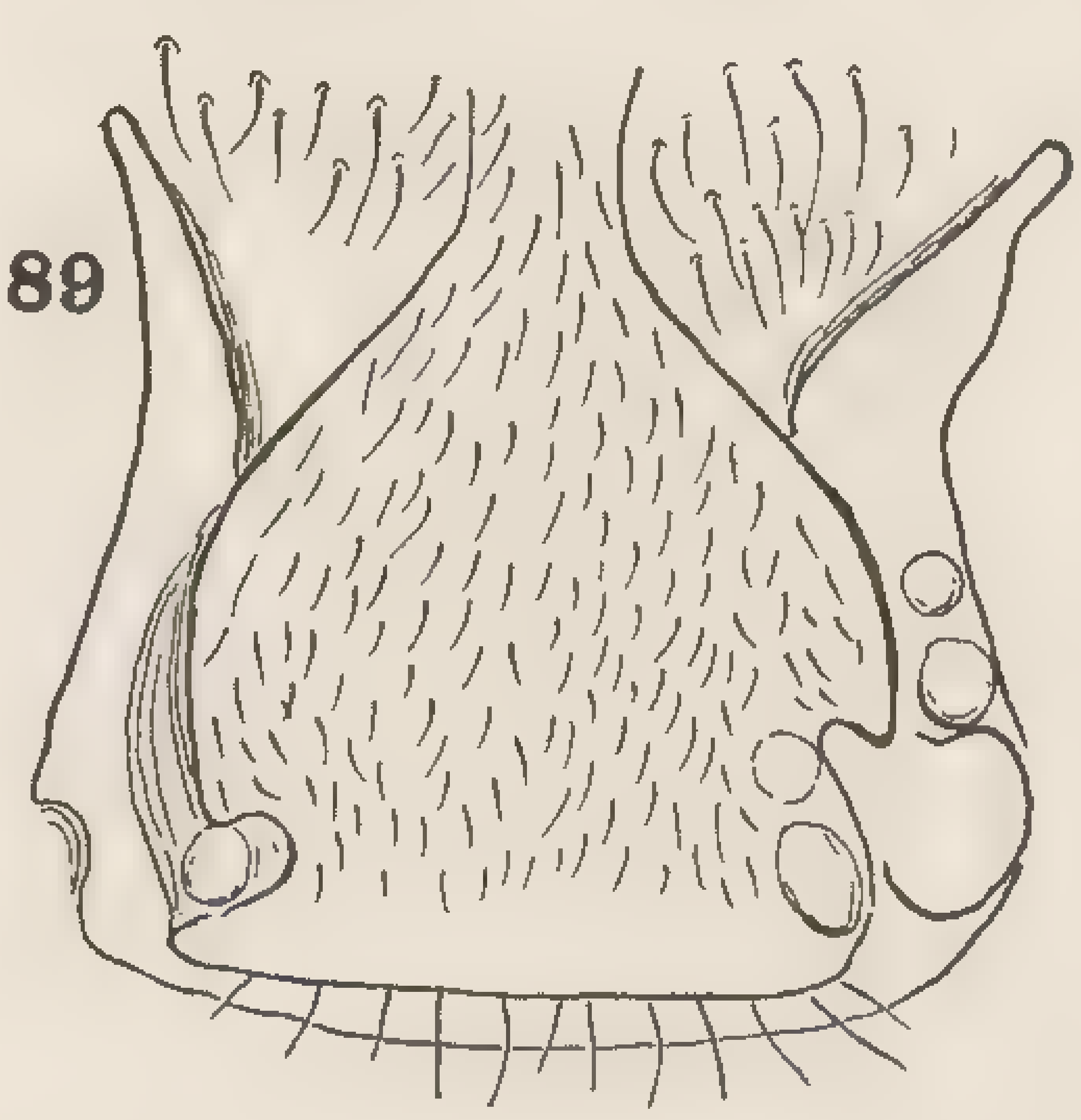
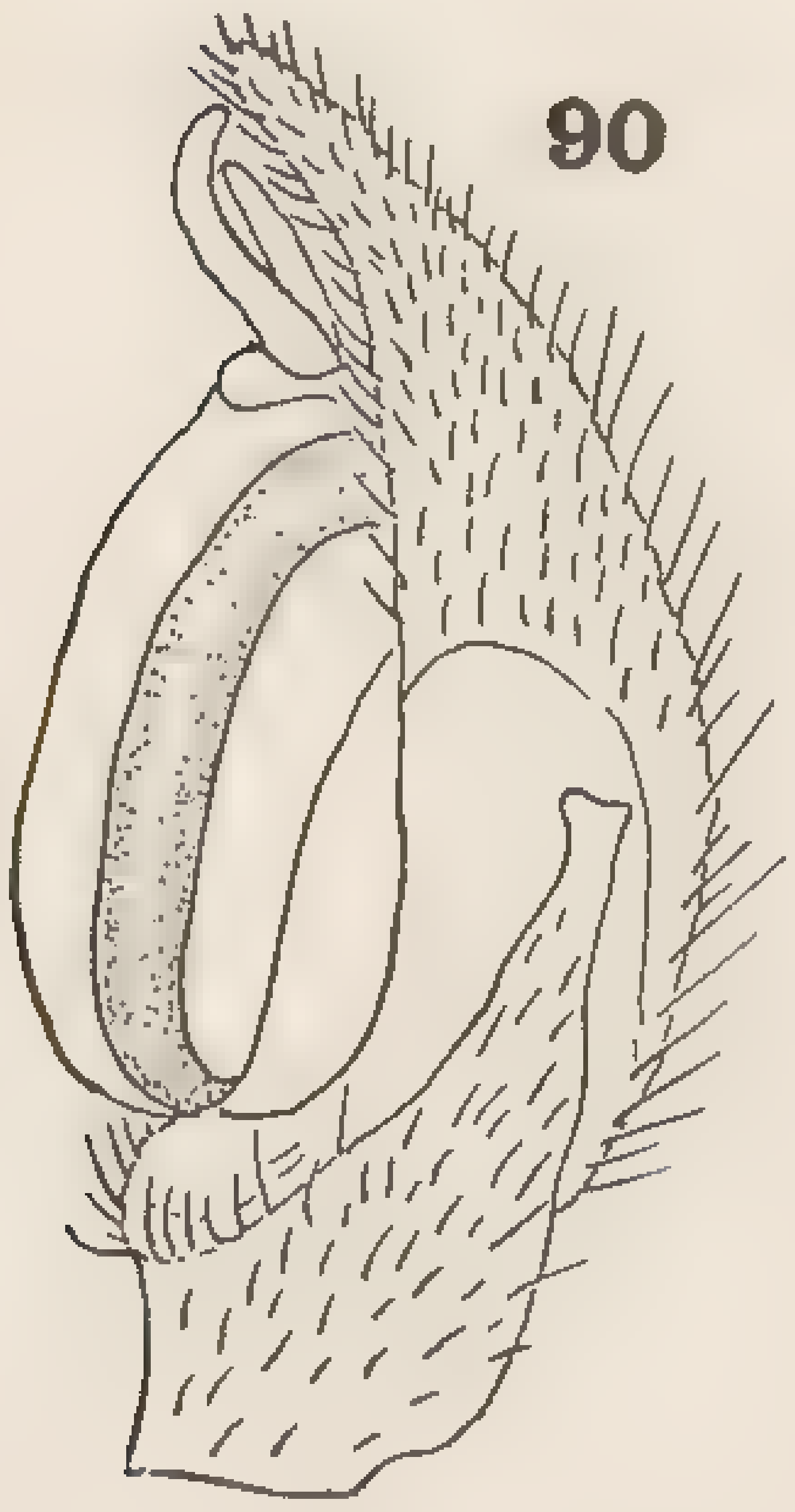

89

PLATE 10

PLATE 10

Fig. 90. *Caridrassus magnus* spec. nov., left palpus.
Fig. 91. *Poecilochroa inconspicua* spec. nov., epigynum.
Fig. 92. *Teminius insularis* Keys., left palpus.
Fig. 93. *Teminius insularis* Keys., epigynum.
Fig. 94. *Teminius monticolus* spec. nov., epigynum.
Fig. 95. *Cupiennius sallei* (Keys.), epigynum.
Fig. 96. *Gephyrina punctata* spec. nov., eyes of the female.
Fig. 97. *Gephyrina punctata* spec. nov., epigynum.
Fig. 98. *Selenops trifidus* spec. nov., tibia of the left palpus.
Fig. 99. *Stasina saetosa* spec. nov., epigynum.
Fig. 100. *Selenops trifidus* spec. nov., left palpus.



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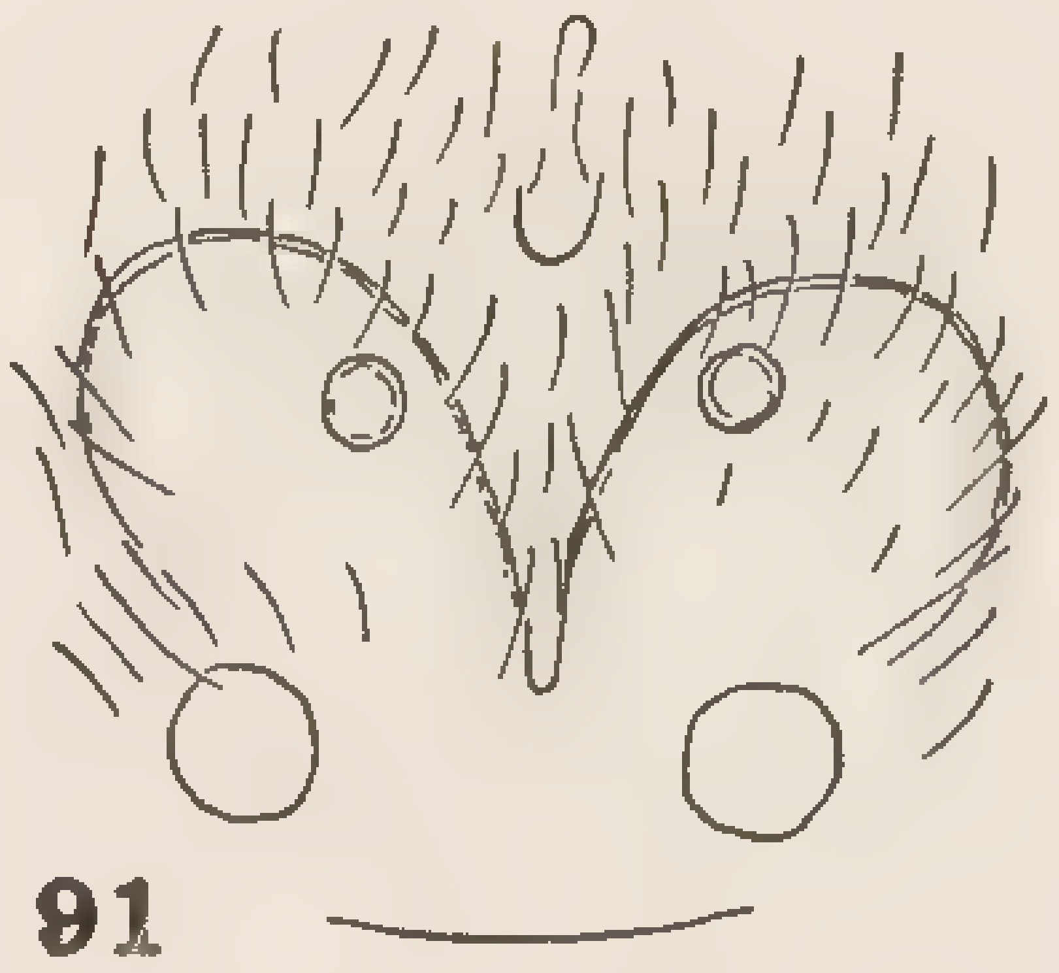

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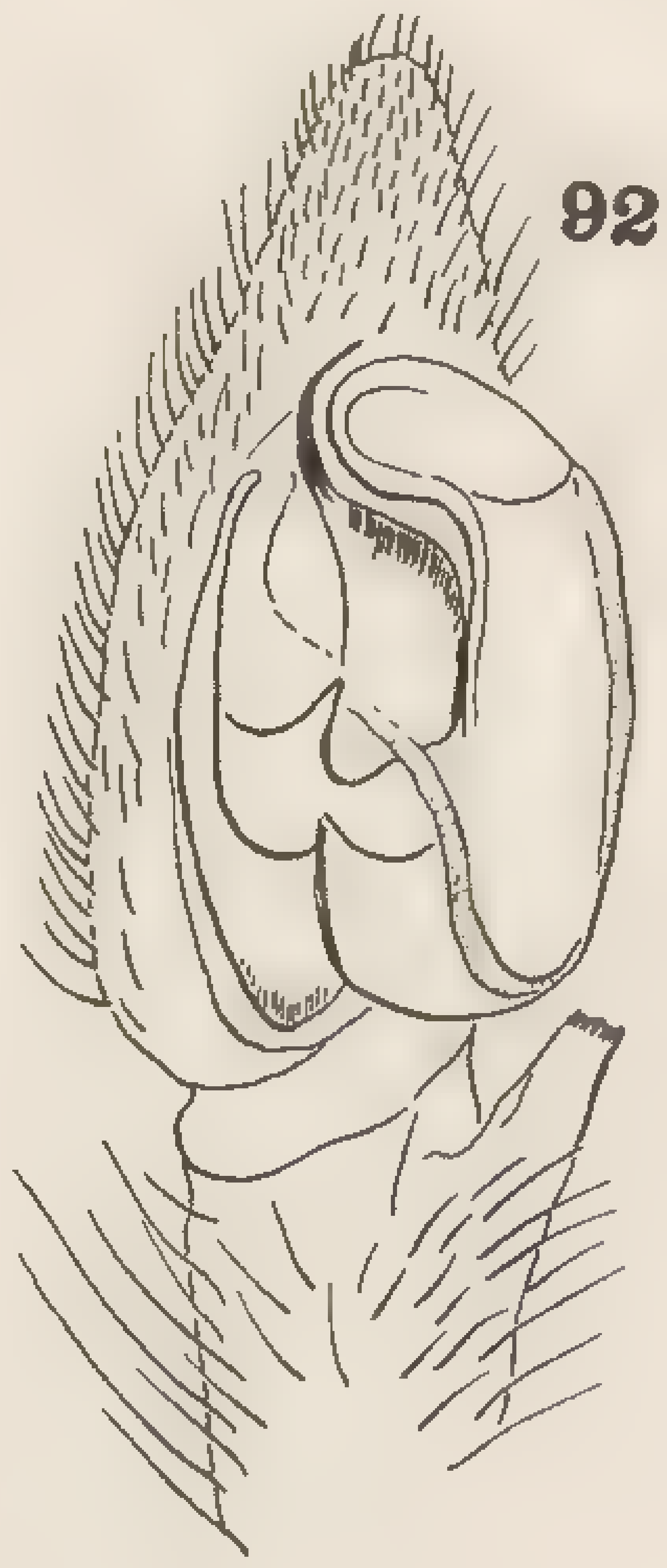

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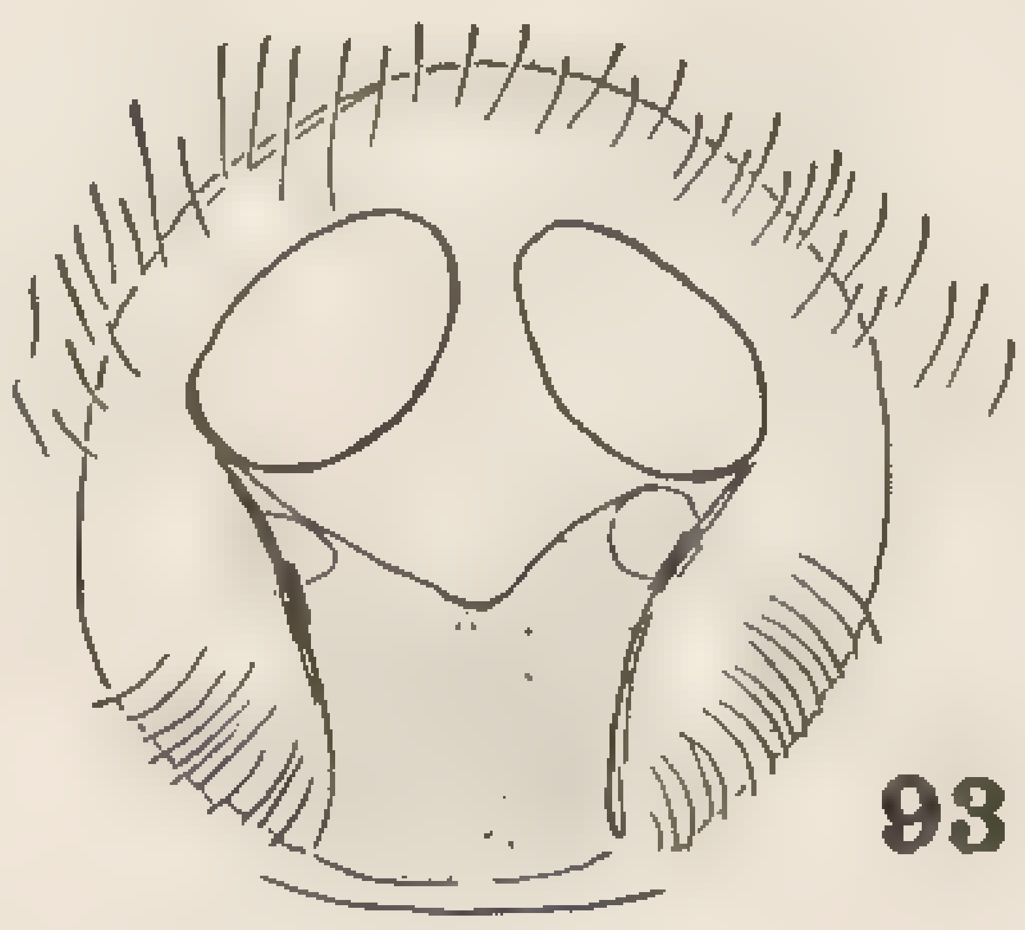

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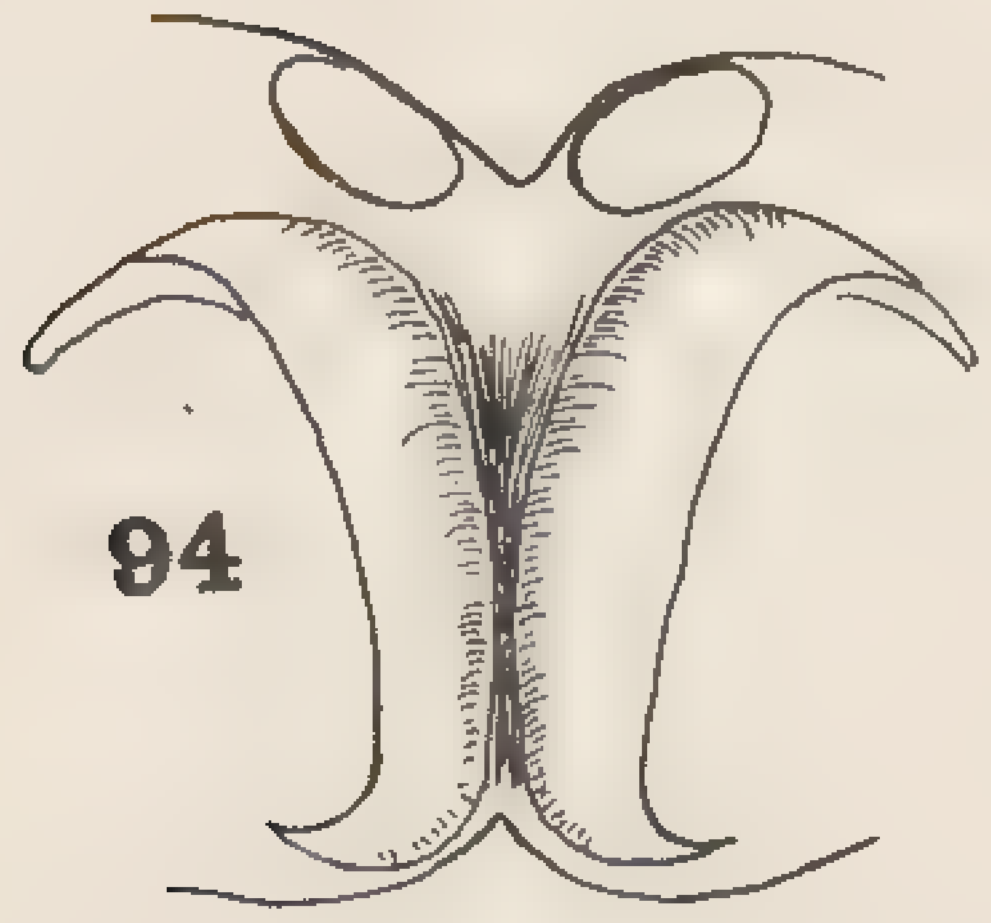

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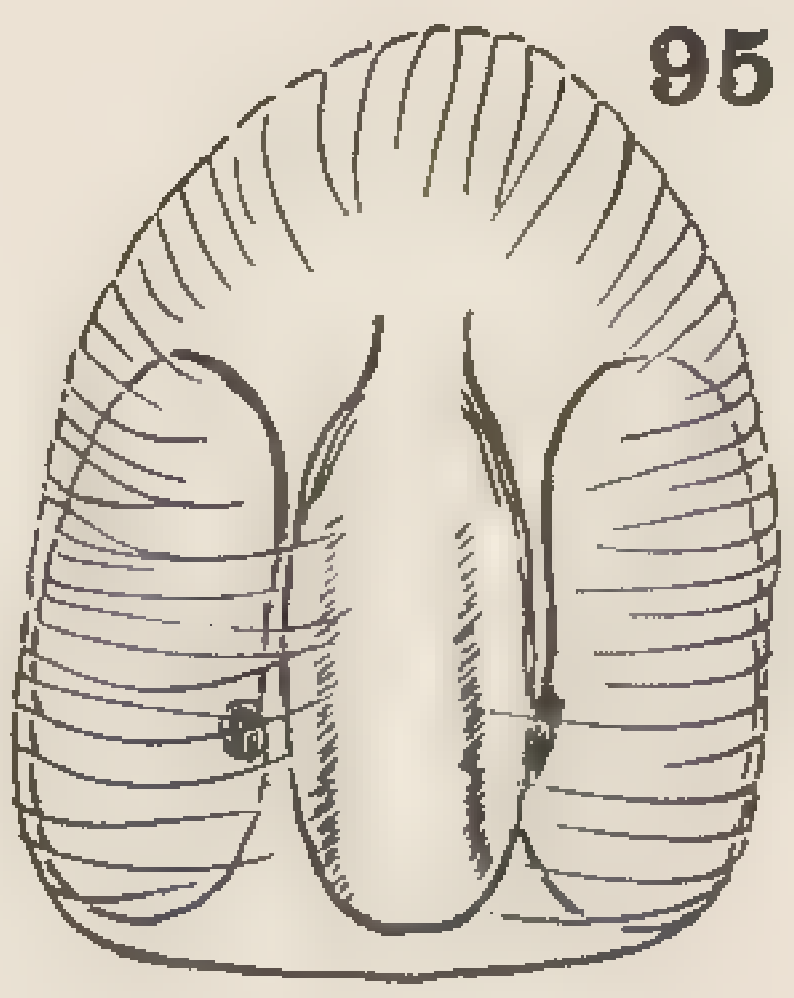

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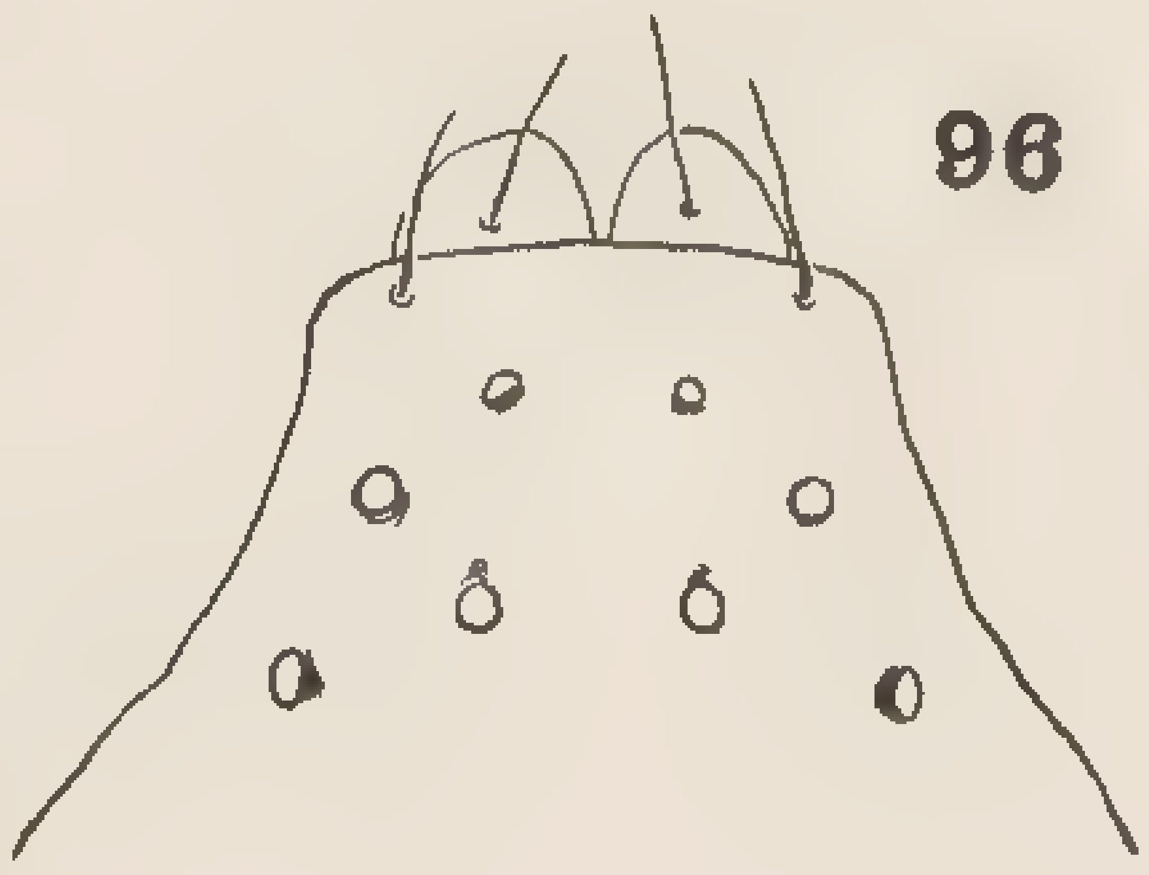

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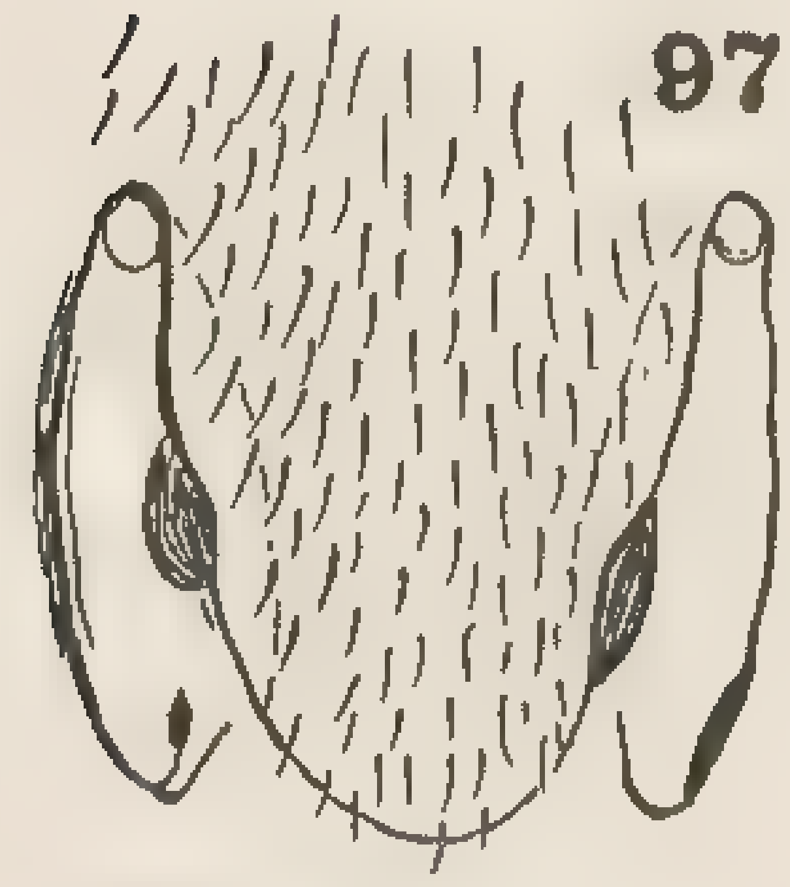

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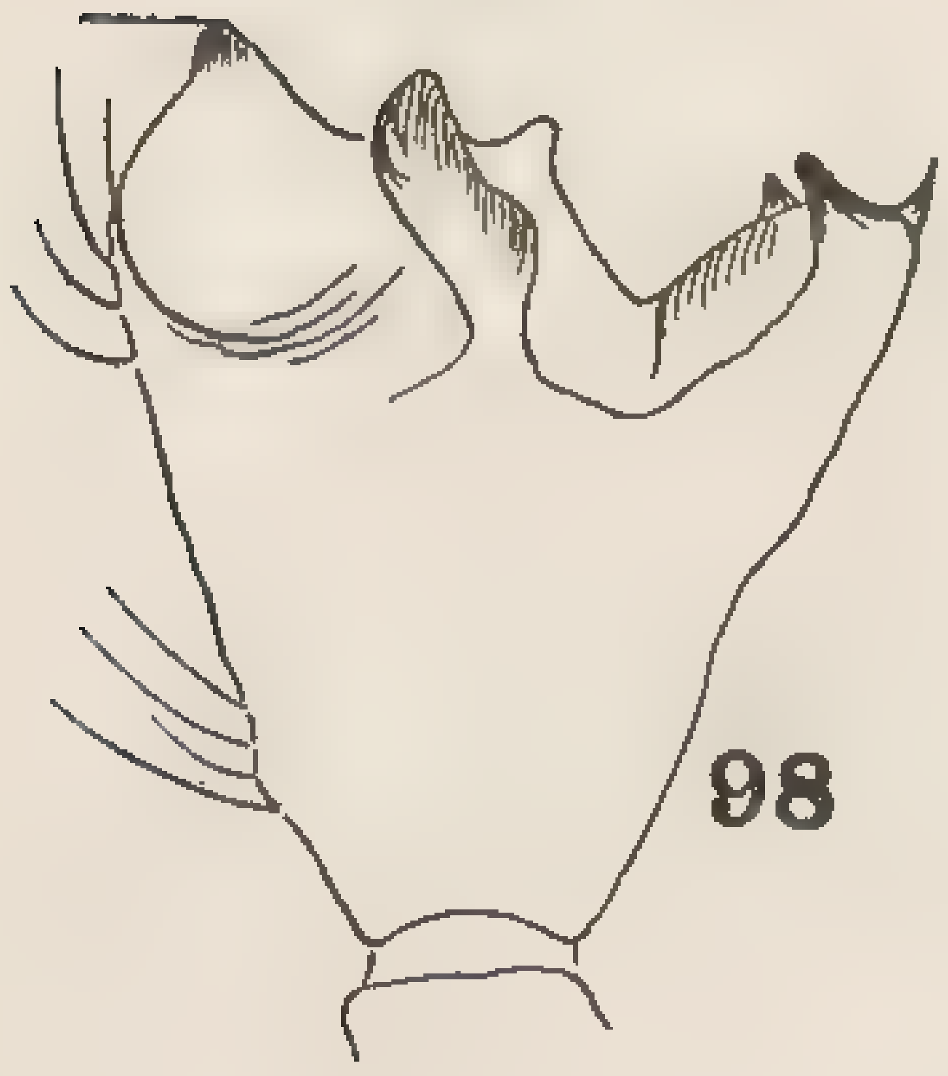

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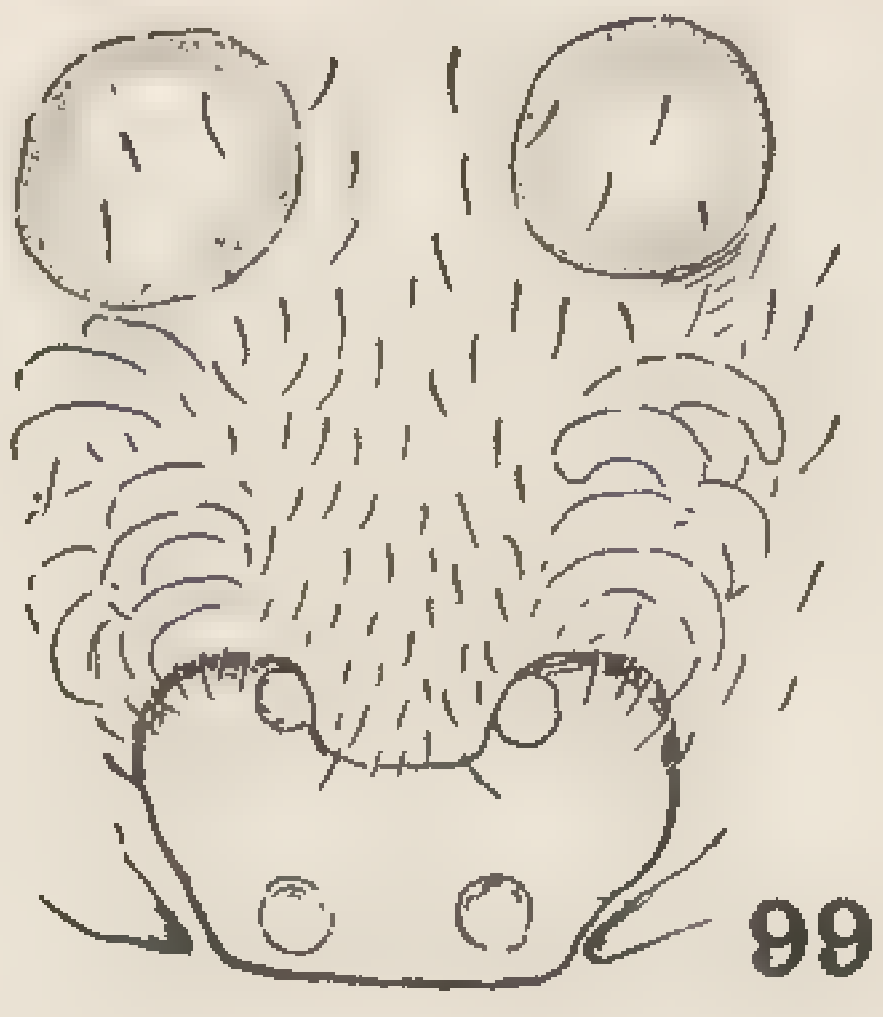

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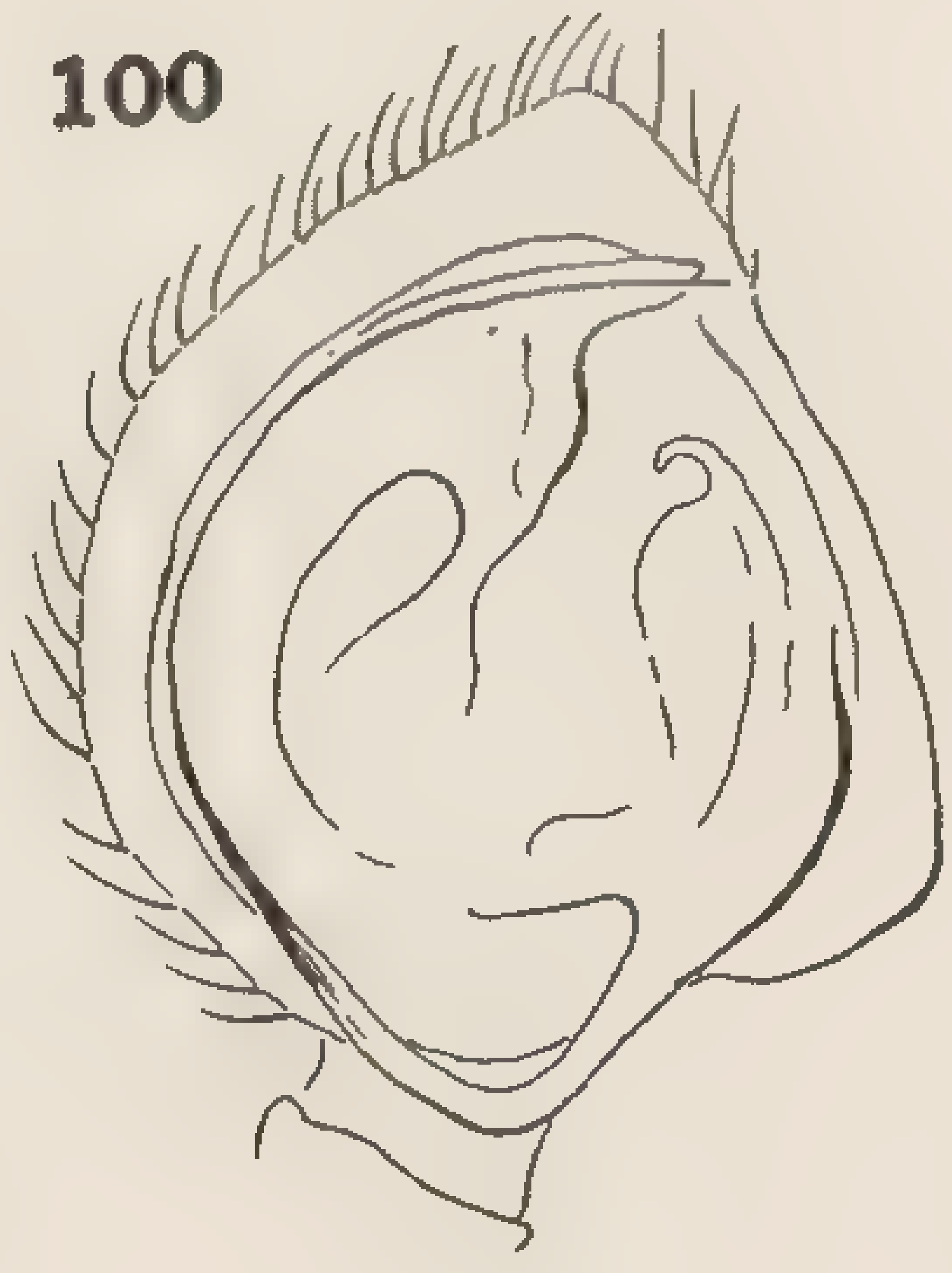


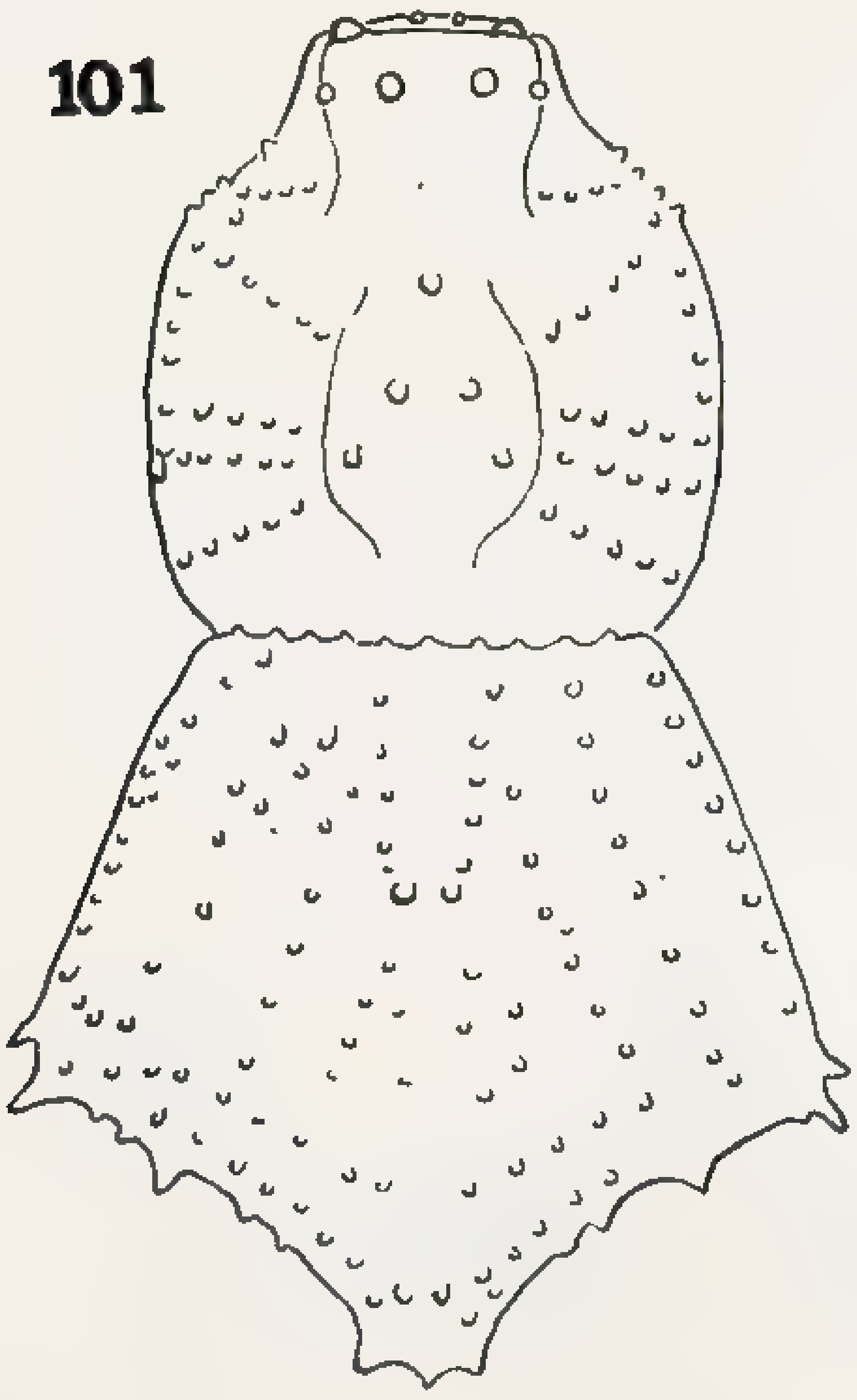
100

PLATE 11

PLATE 11

Fig. 101. *Onoculus venustus* spec. nov., dorsal view of the male.
Fig. 102. *Onoculus venustus* spec. nov., eyes of the female.
Fig. 103. *Onoculus venustus* spec. nov., epigynum.
Fig. 104. *Onoculus venustus* spec. nov., left palpus.
Fig. 105. *Anyphaena modesta* spec. nov., epigynum.
Fig. 106. *Anyphaena remota* spec. nov., tibia and patella of the right palpus.
Fig. 107. *Anyphaena lauta* spec. nov., epigynum.
Fig. 108. *Anyphaena pusilla* spec. nov., epigynum.
Fig. 109. *Anyphaenella fascicula* spec. nov., left palpus, ventral.
Fig. 110. *Anyphaenella fascicula* spec. nov., epigynum.
Fig. 111. *Anyphaena remota* spec. nov., right palpus, ventral.

101



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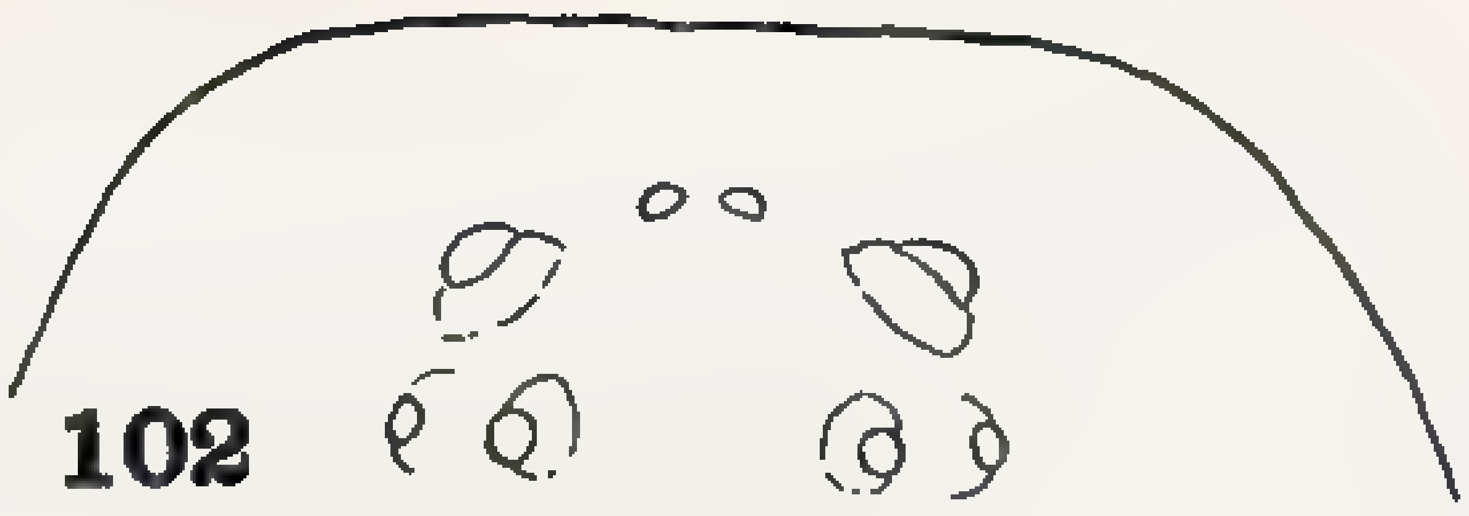

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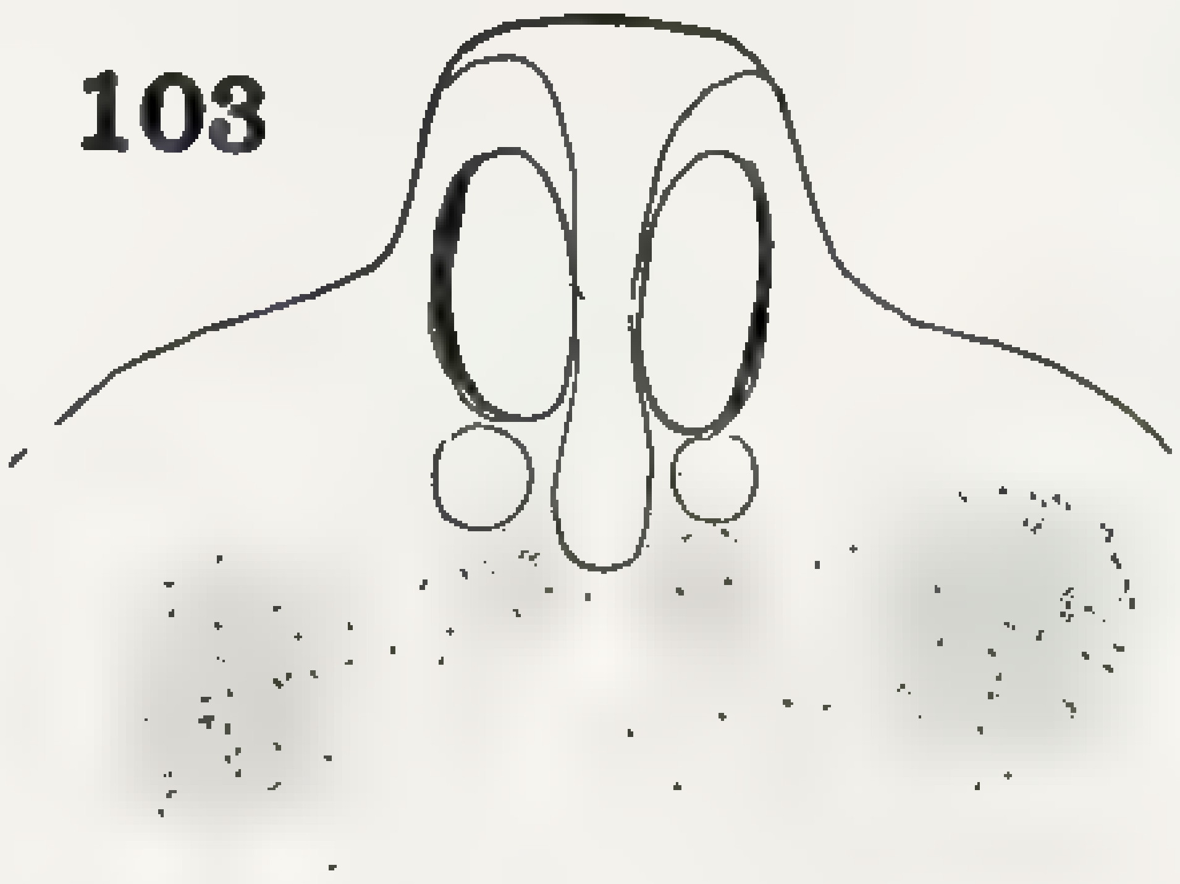

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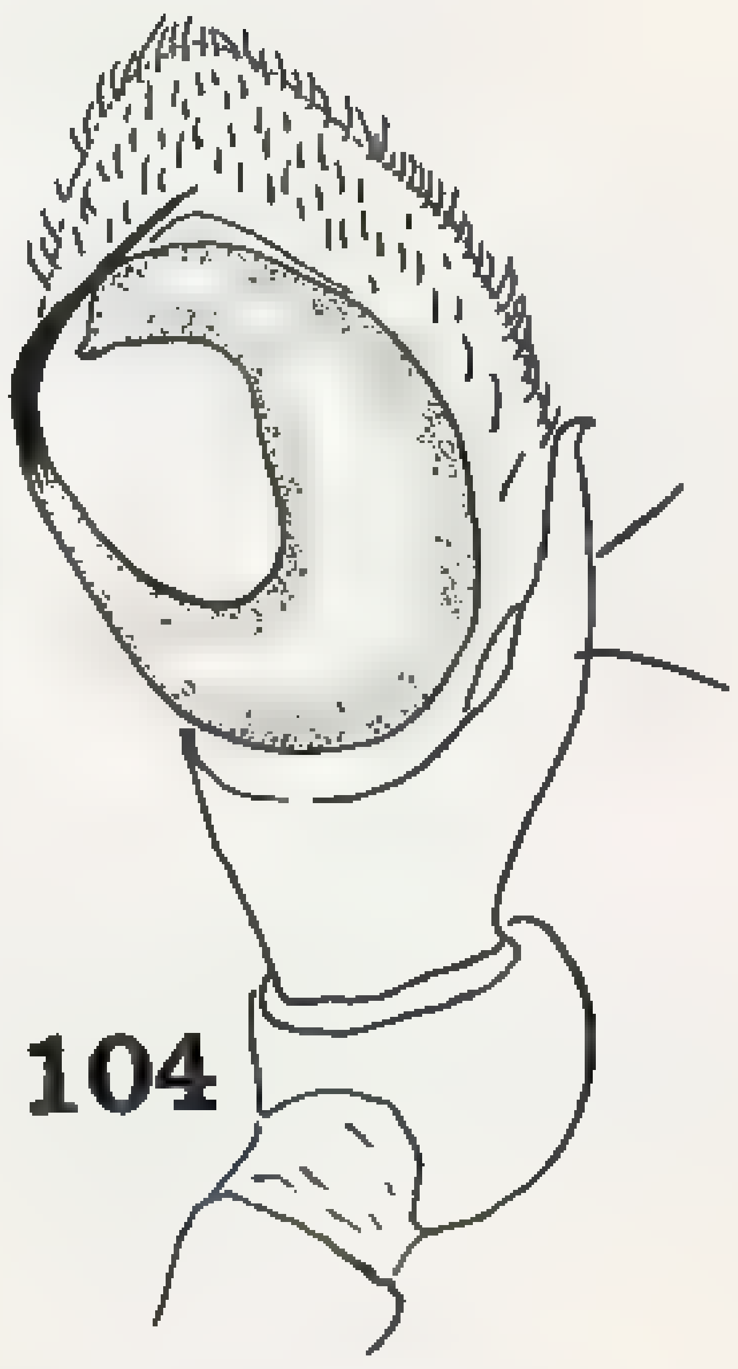

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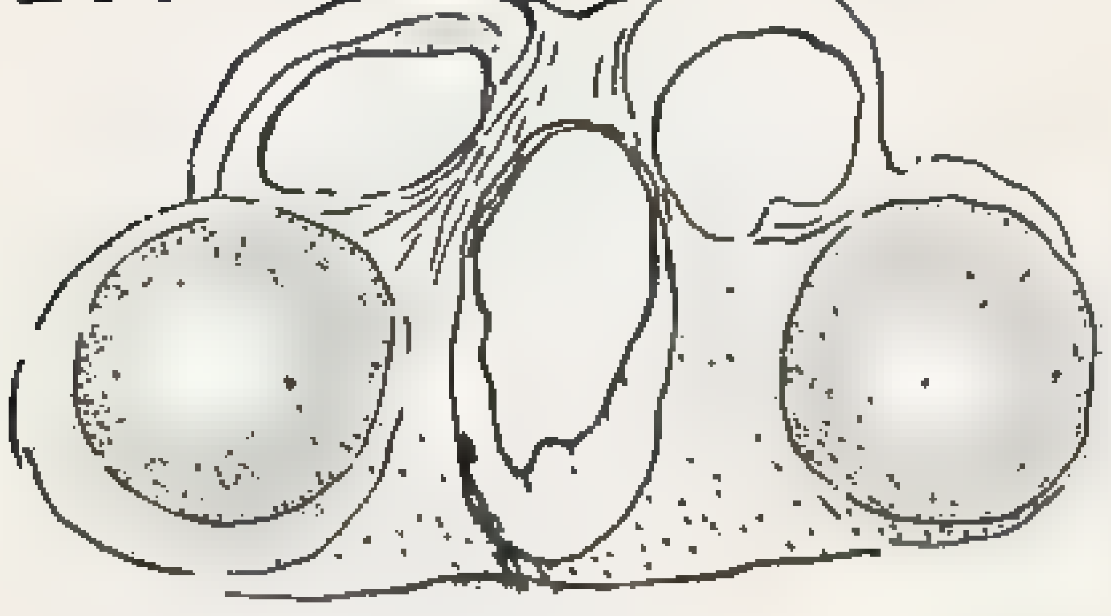

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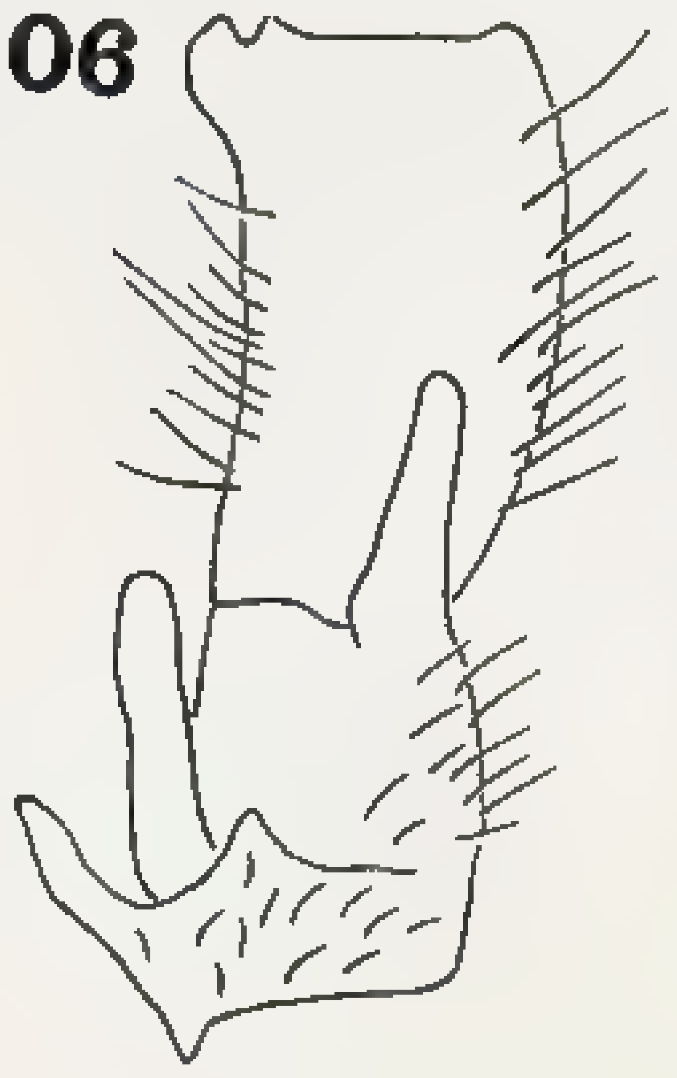

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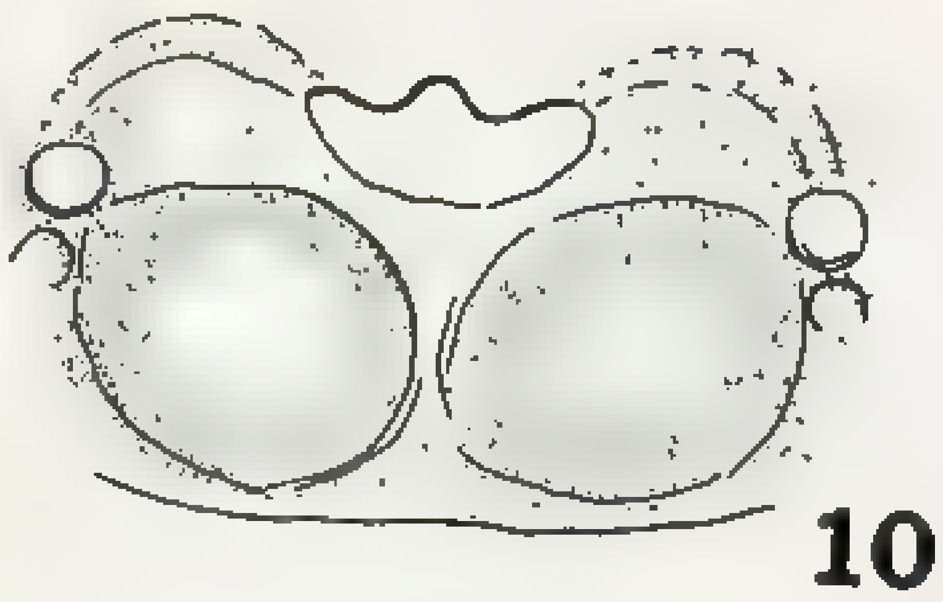

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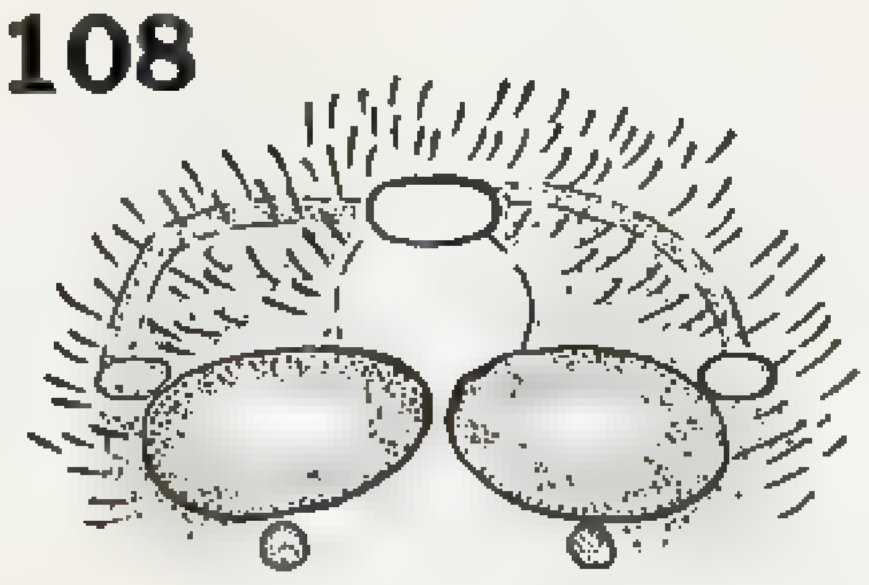

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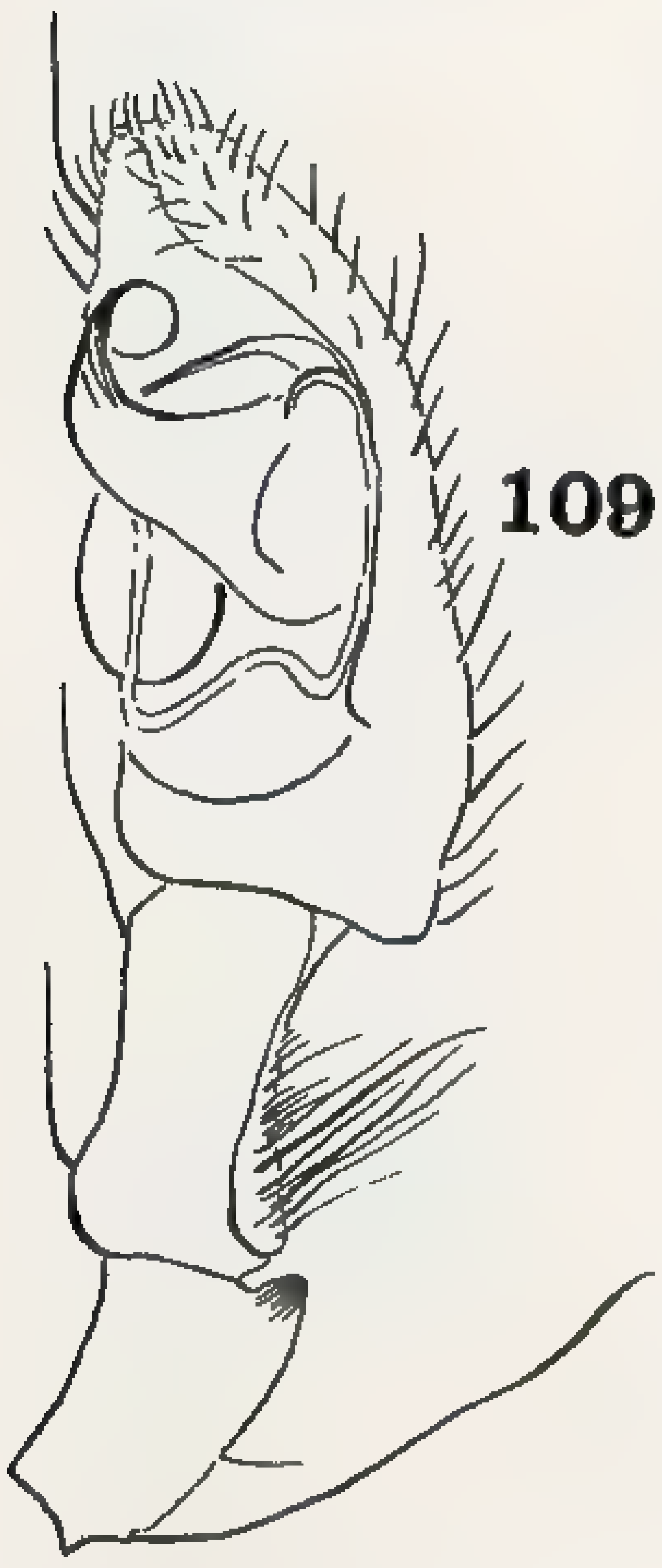

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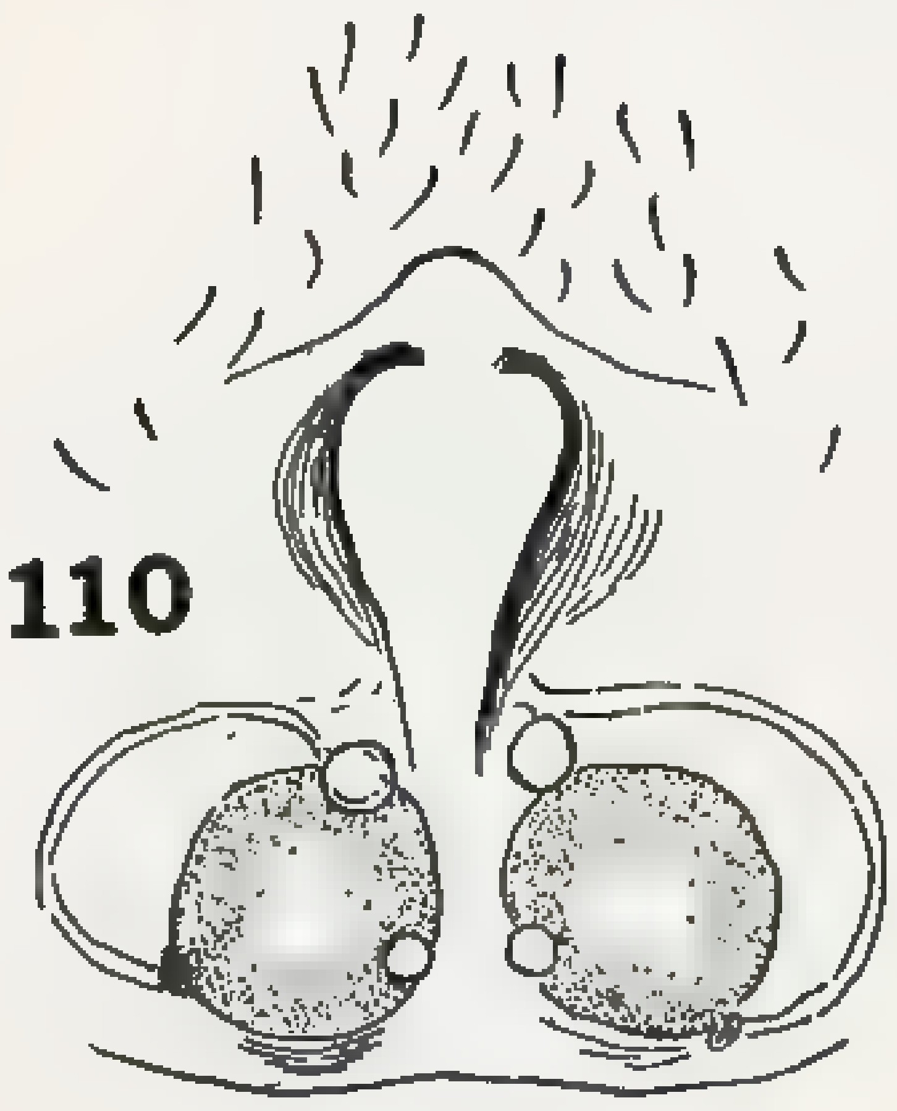

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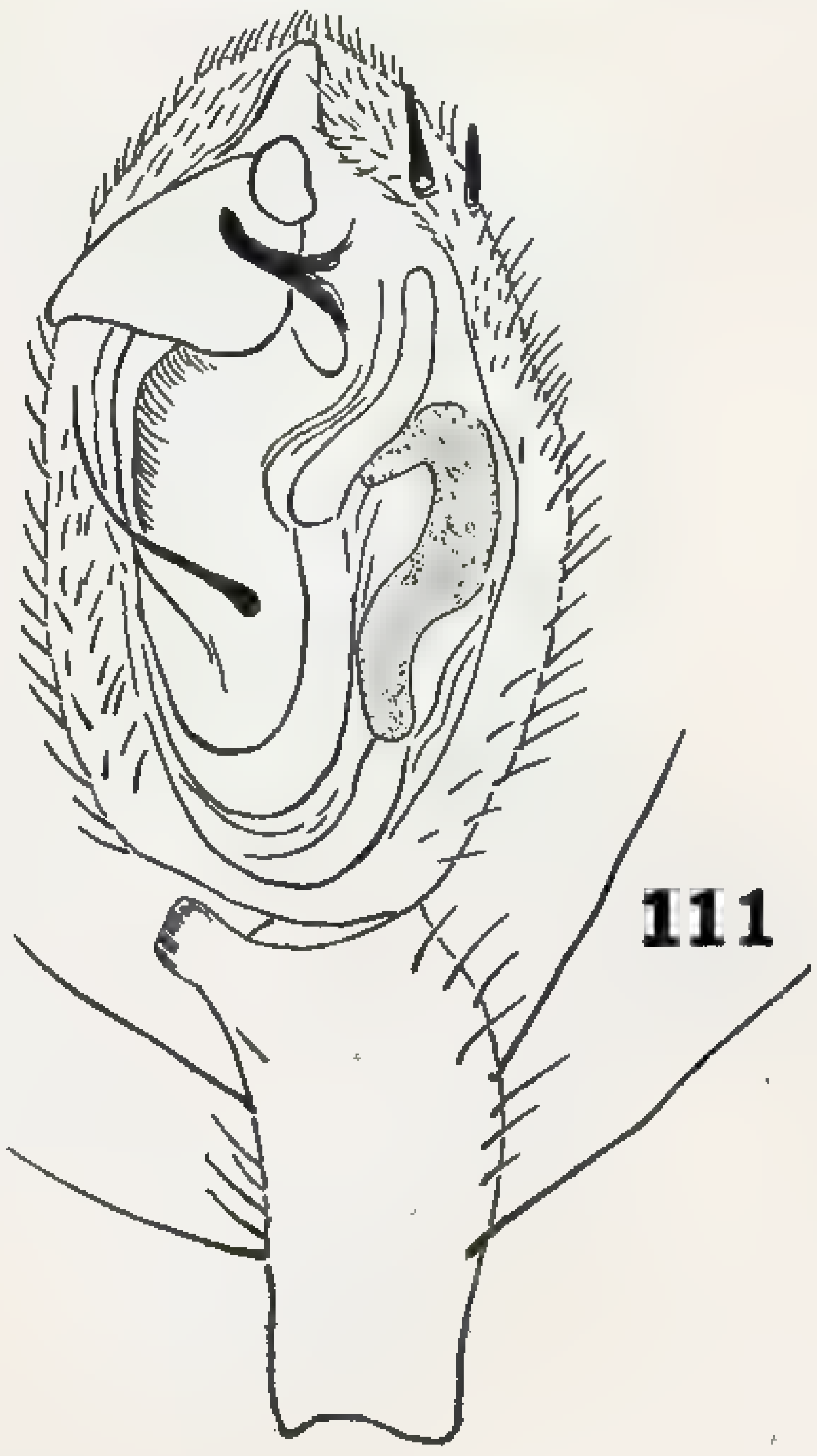
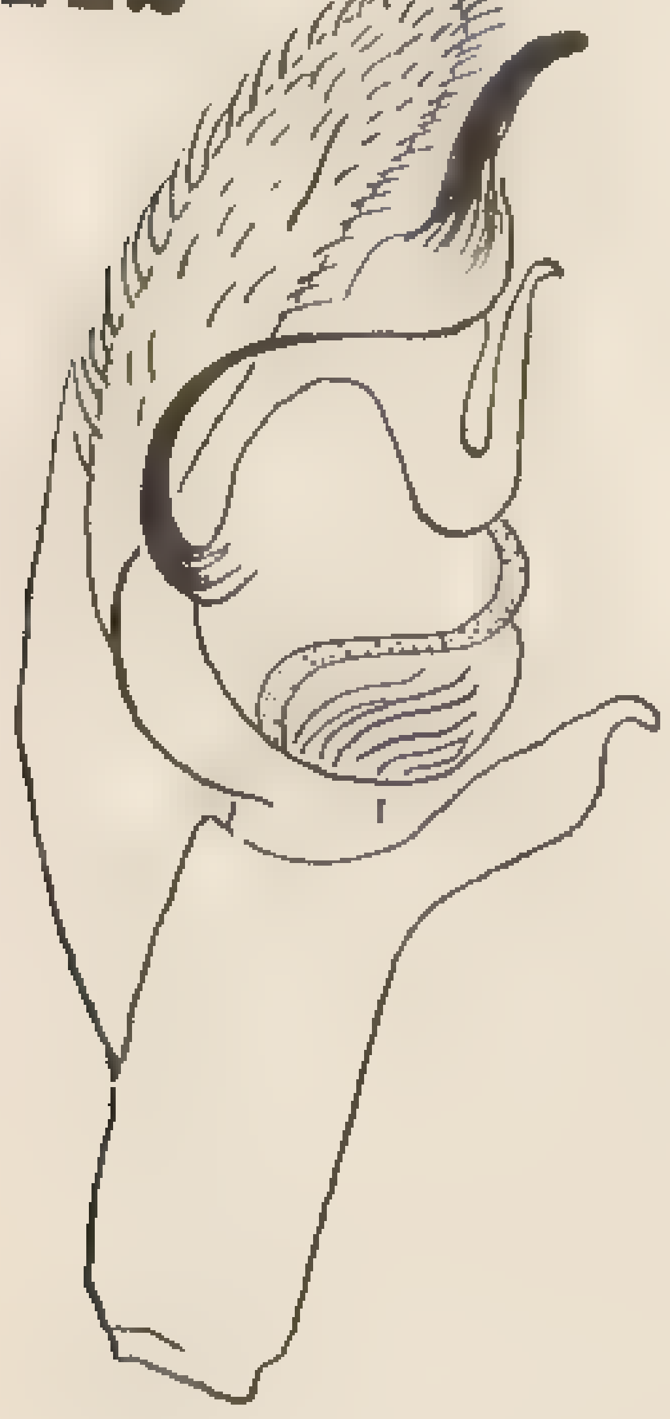


PLATE **12**

PLATE **12**

Fig. 112.	*Temnida parvula* (Banks), left palpus, retrolateral.
Fig. 113.	*Temnida parvula* (Banks), tibia of left palpus.
Fig. 114.	*Corinna toussainti* spec. nov., epigynum.
Fig. 115.	*Aysha ferox* Simon, left palpus, retrolateral.
Fig. 116.	*Phrurolithus spinosus* spec. nov., epigynum.
Fig. 117.	*Anyphaenella gracilipes* (Banks), epigynum.
Fig. 118.	*Anyphaenella fragilis* spec. nov., epigynum.
Fig. 119.	*Temnida parvula* (Banks), epigynum.
Fig. 120.	*Corinna parvula* Bryant, left palpus, ventral.
Fig. 121.	*Temnida spinosa* spec. nov., epigynum.
Fig. 122.	*Lausus pulchellus* spec. nov., epigynum.
Fig. 123.	*Corinna toussainti* spec. nov., left palpus, ventral.

112



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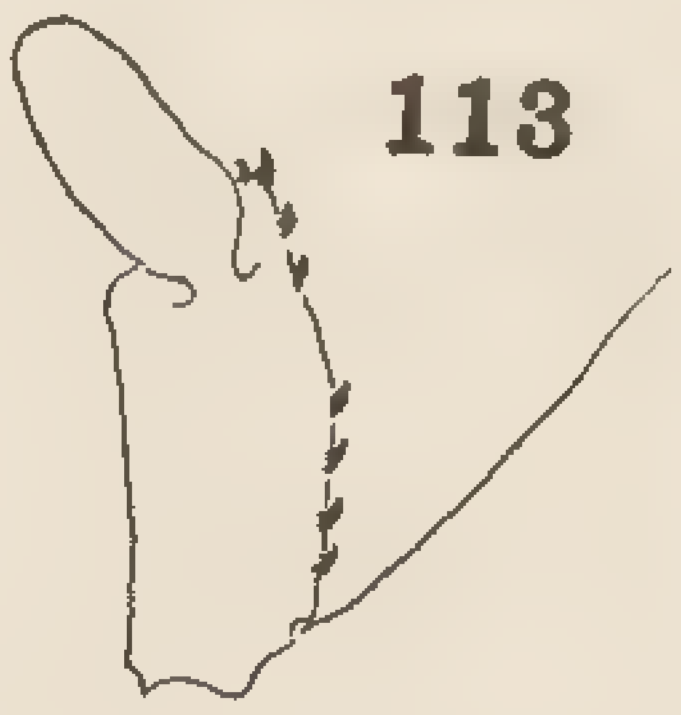

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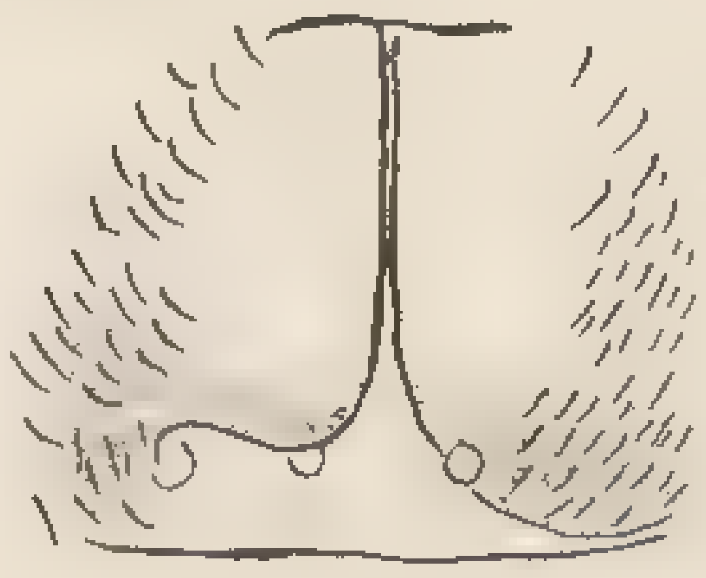

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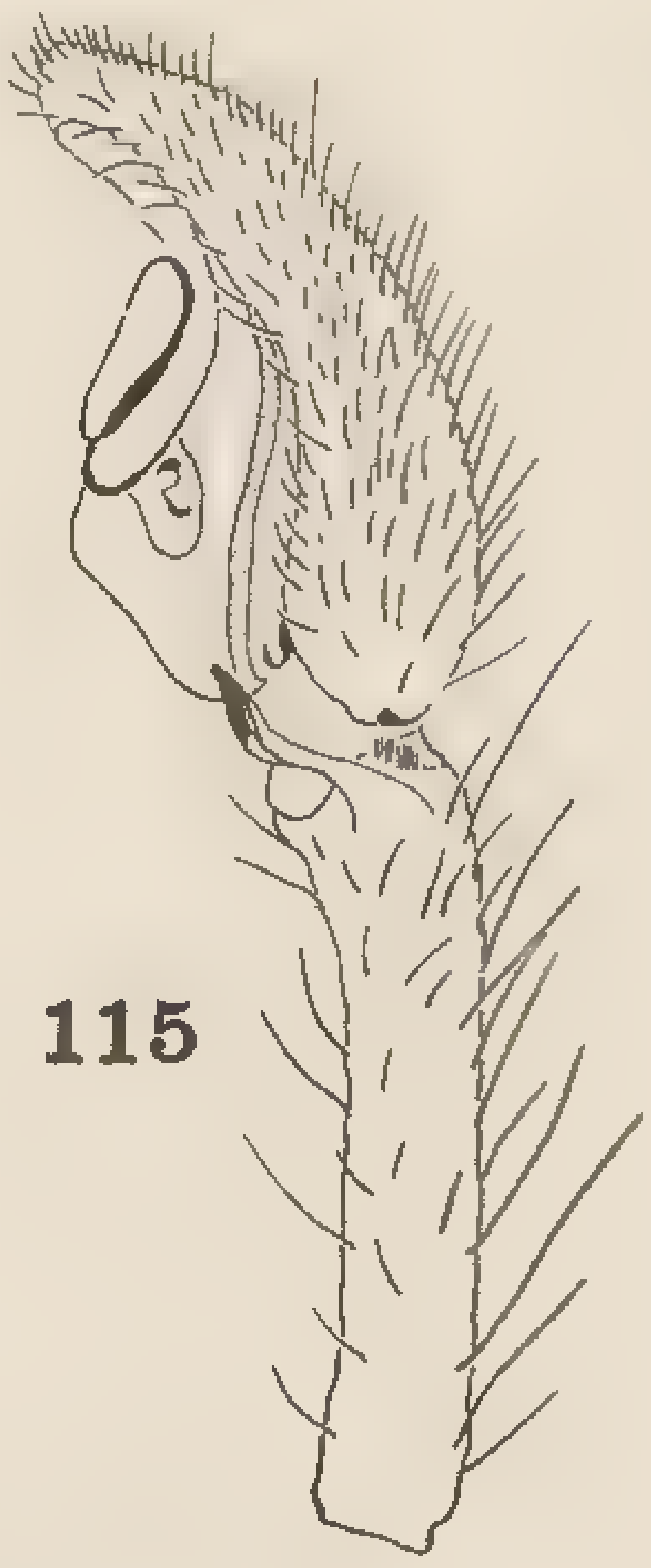

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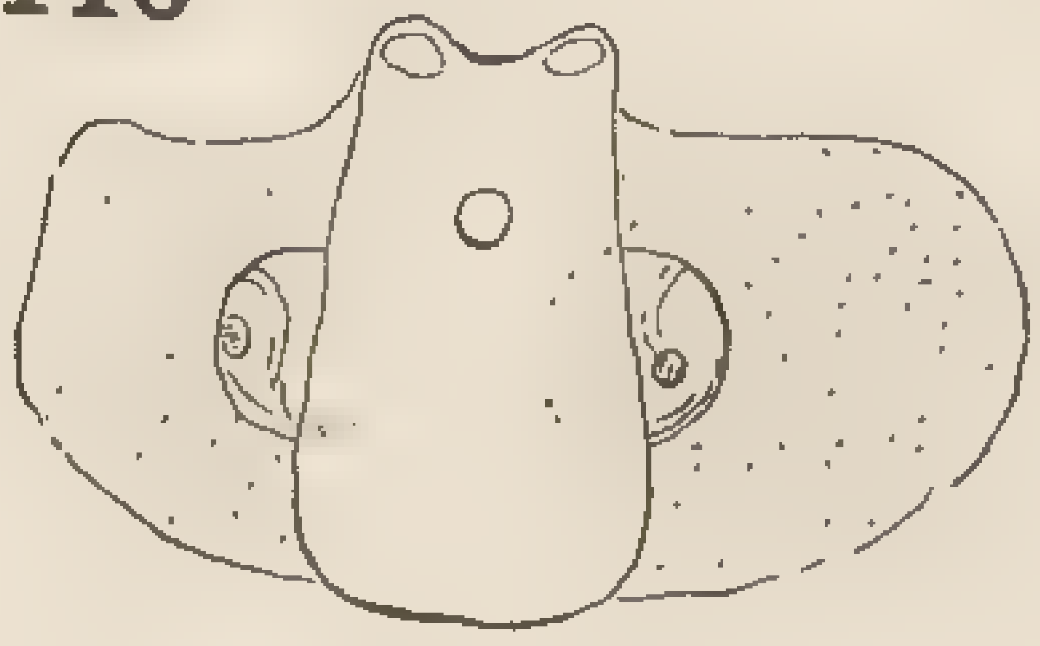

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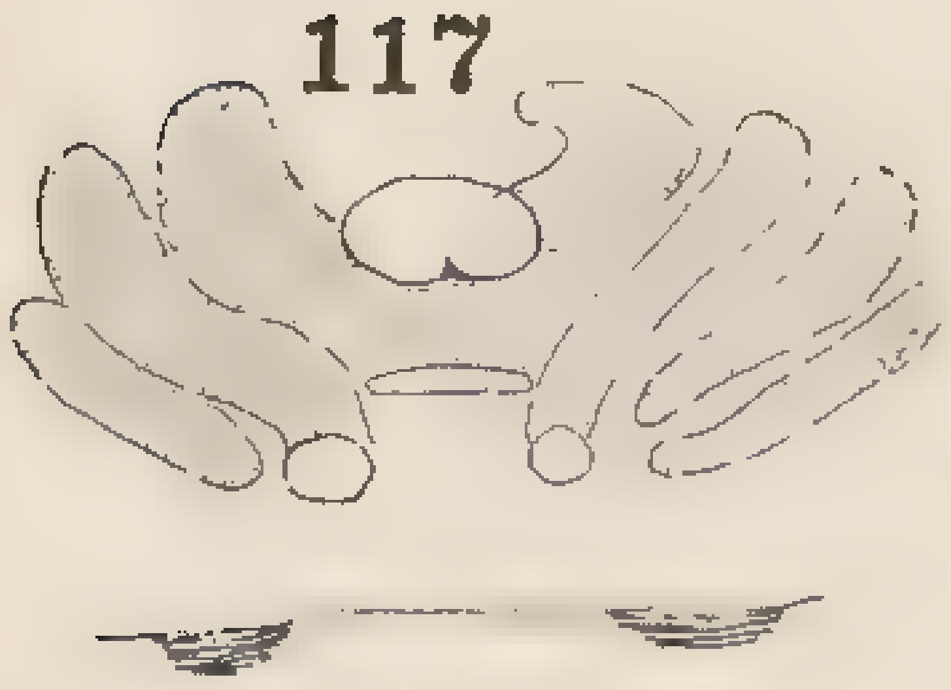

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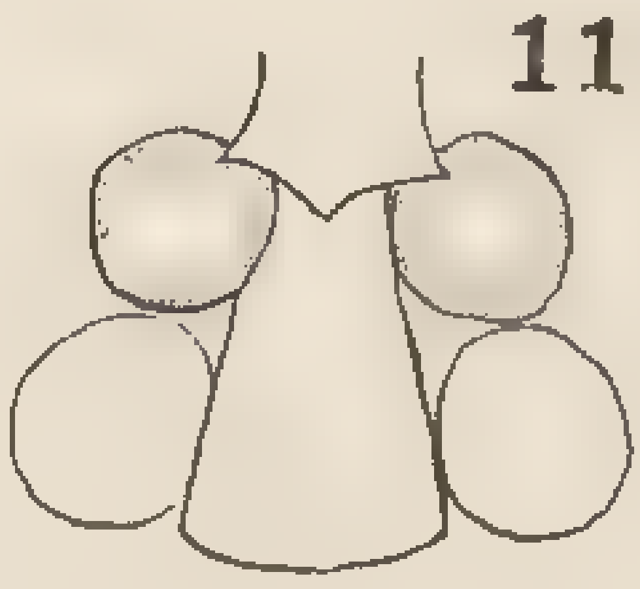

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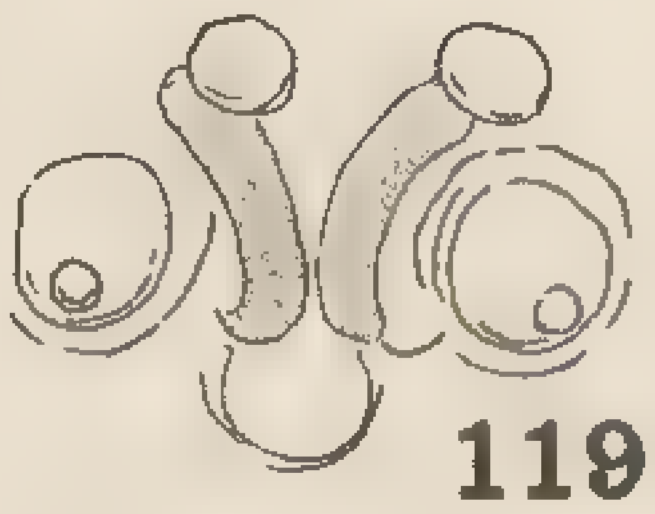

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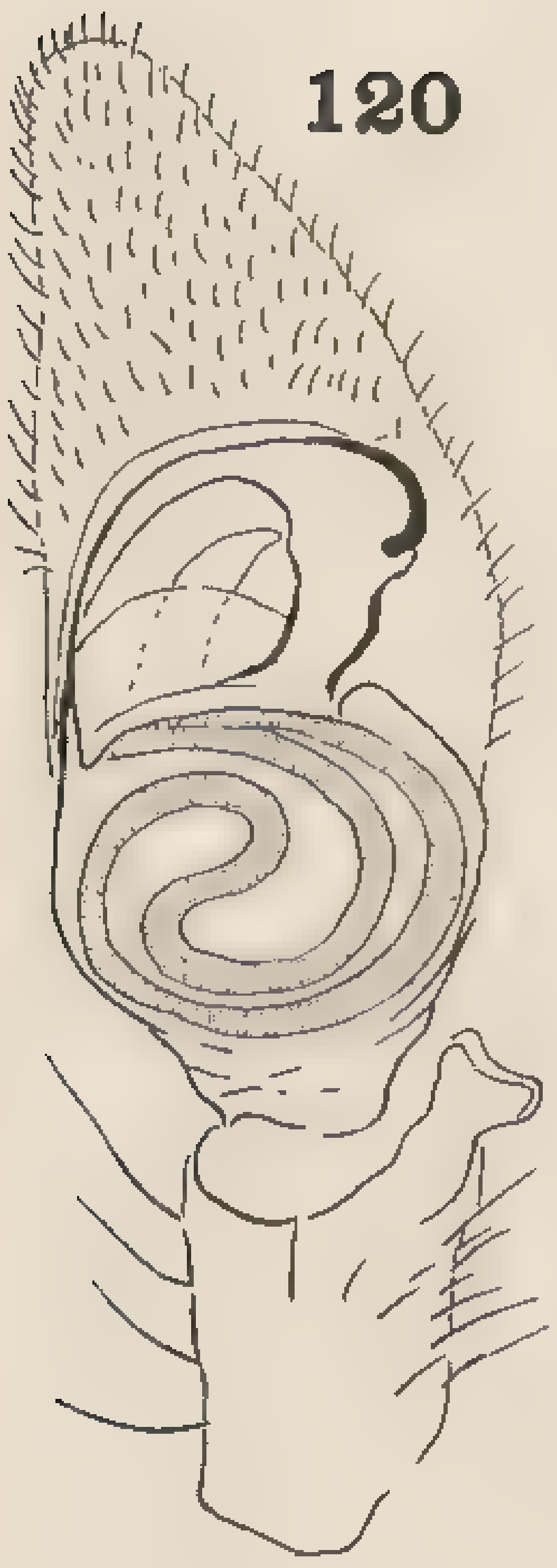

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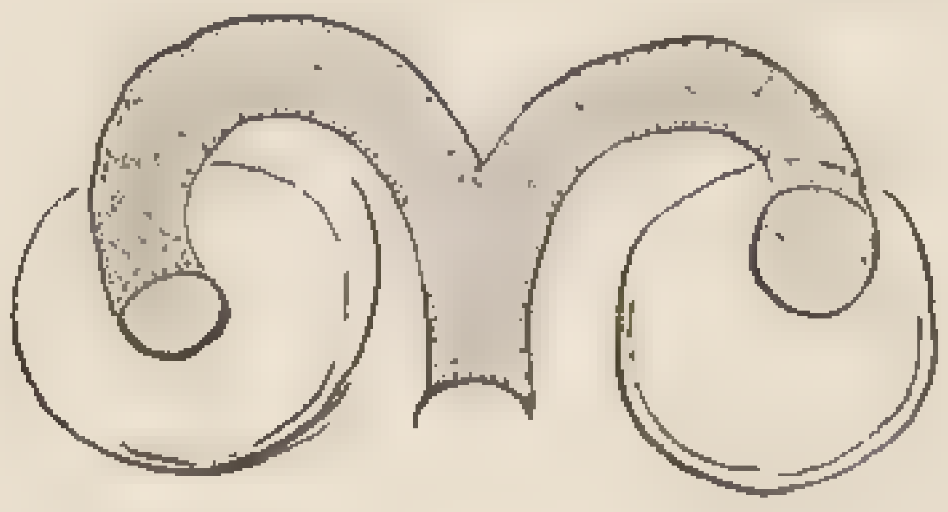

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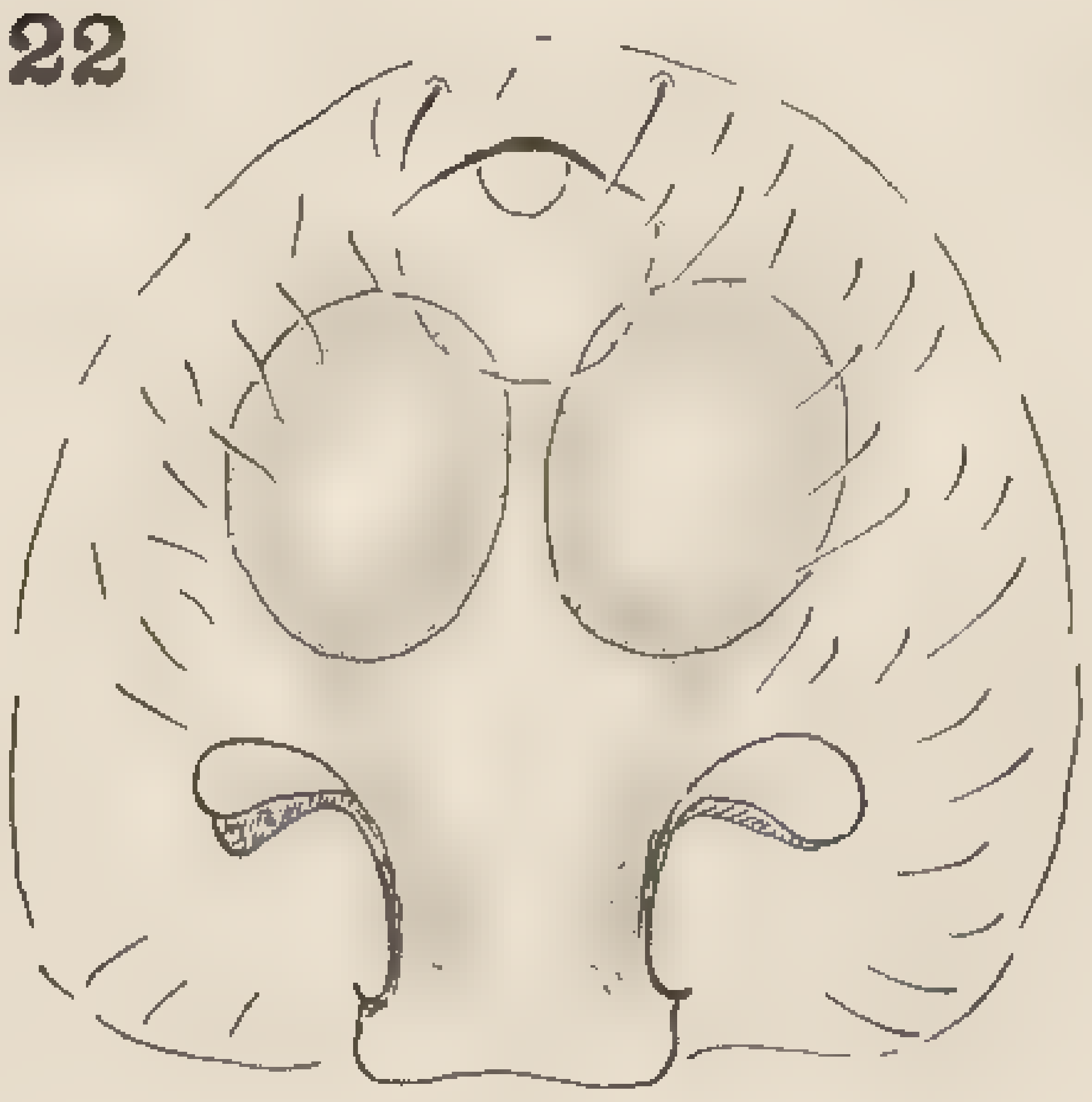

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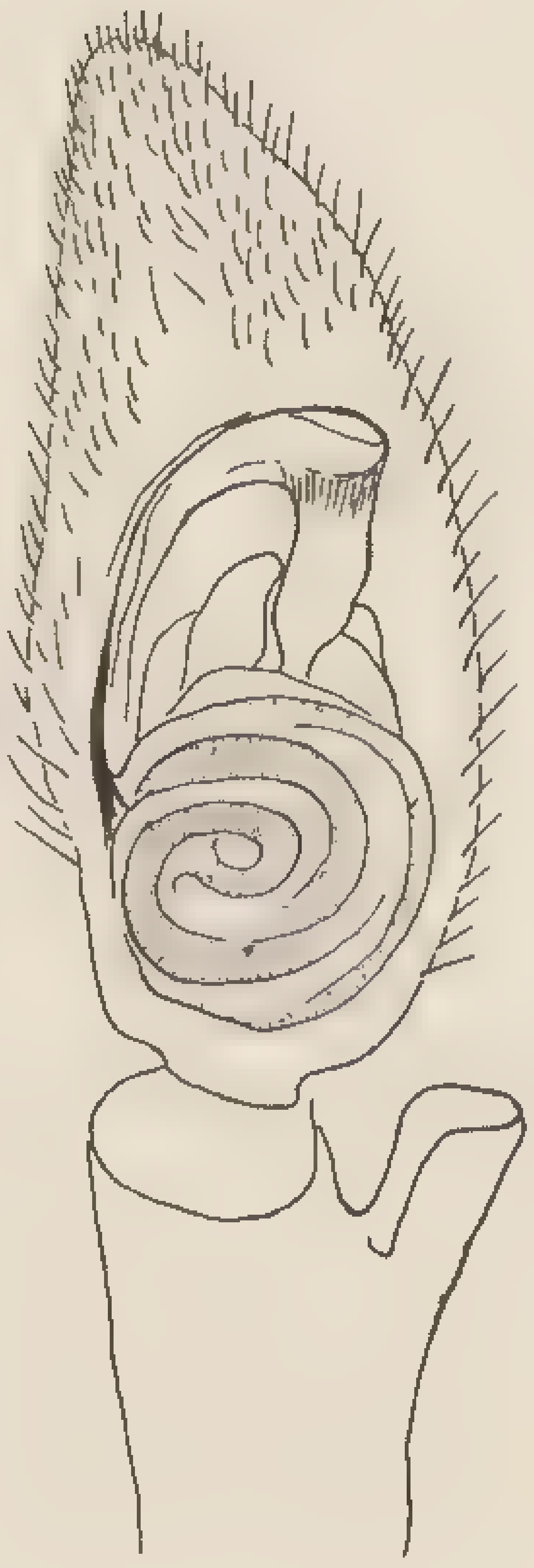

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AT HARVARD COLLEGE

Vol. 100, Nos. 5 and 6

Museum of Comparative Zoology
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By Preston E. Cloud, Jr.

and

No. 6. A NEW GENUS OF BRACHIOPODA FROM THE LONGVIEW LIMESTONE OF VIRGINIA

By G. Arthur Cooper

With Four Plates

CAMBRIDGE, MASS., U. S. A.
PRINTED FOR THE MUSEUM
June, 1948

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No. 5.—Brachiopods from the Lower Ordovician of Texas[1]

by

PRESTON E. CLOUD, JR.

ABSTRACT

To the 14 genera of brachiopods previously reported from the Lower Ordovician of Texas 9 are here added. Of these 23 genera only one, *Calliglypha*, was previously undescribed. But of the 40 or more species which they include, only 14 are known to have been described elsewhere. Seven new names are proposed for species from Texas; and an eighth new species, from Oklahoma, is introduced for comparison.

Only in the central part of the State are stratigraphic studies of the Lower Ordovician rocks of Texas reasonably complete. In these rocks the total known brachiopod "fauna" of 6 genera, with 13 or more species, probably represents a fair proportion of the brachiopods to be found there. The present paper deals mainly with these fossils.

In West Texas brachiopods are reasonably common in the El Paso formation, but detailed biostratigraphic studies have yet to be made. Eventual additions to the brachiopod fauna of this region are expected.

Ulrich and Cooper (1938) probably described most of the genera of Lower Ordovician brachiopods. However, many additional species and occasional genera will doubtless be added to the record with further investigations of the Lower Ordovician rocks in the western United States and other regions where studies to date have been mainly in the form of reconnaissance.

Brachiopods have proved to be very useful in the correlation of Lower Ordovician rocks. Many genera have restricted stratigraphic ranges, as well as distinctive internal features by which properly prepared specimens may be readily identified.

GENERAL REMARKS

Intensive coöperative field study of the Ellenburger group of central Texas was carried on by the U. S. Geological Survey and the Bureau of Economic Geology of the University of Texas between December 1943 and July 1945 (Cloud, Barnes, and Bridge 1945; Cloud and Barnes 1946, and *in press*). During this work, which in part included reconnaissance studies of other Lower Ordovician rocks of the mid-Continent, a particular effort was made to obtain brachiopods, because of their importance in establishing correlation with those regions where the more widely known molluscan fauna is not well developed.

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[1] Published by permission of the Director, U. S. Geological Survey, and with the aid of a special gift from Mr. G. R. Agassiz.

Brachiopod genera previously reported from the Lower Ordovician strata of Texas were *Lingulepis, Lingulella, Lingula, Acrotreta, Paterula, Archaeorthis, Orthis, Hesperonomia, Finkelnburgia, Diparelasma, Tritoechia, Tetralobula, Syntrophina,* and *Syntrophopsis.* To these are here added the genera *Nanorthis, Nothorthis, Oligorthis, Polytoechia, Clarkella, Diaphelasma, Syntrophinella, Calliglypha* (new), and *Xenelasma.*

The Lower Ordovician brachiopods are commonly preserved either by silicification of the shell or as impressions in chert, revealing the internal details with clarity and permitting ready generic determination of properly prepared specimens. Many of the genera have restricted stratigraphic ranges, and probably most of them have been described by Ulrich and Cooper in their classic work on the "Ozarkian and Canadian Brachiopoda" (1938). As for the species, however, the present study offers cogent support of the statement by Ulrich and Cooper (1938, p. 6) that, "only a beginning has been made in the study of these ancient brachiopods." Of the 40 or more species of brachiopods found in the Lower Ordovician of Texas only 14 are assigned to previously described species, 13 of these being species described by Ulrich and Cooper. Seven of the remaining 26 or more species are described as new, 6 are compared with or suggested to have affinities with previously described species, and 13 or more are not assigned to or compared with any named species. If similar results are produced by further investigation of other regions where the Lower Ordovician has not previously been studied in detail, we may expect eventually to know twice as many species of Lower Ordovician brachiopods as are at present described.

The present paper deals mainly with the Ellenburger brachiopods, consisting of 7 genera represented by 13 or more species. It describes also 4 new species and a new genus from the El Paso formation of West Texas and a new species of *Syntrophinella* from the Cool Creek formation of the Arbuckle Mountains of Oklahoma. Brachiopods are relatively common in the El Paso formation, and it may be expected that detailed biostratigraphic study of its rocks will reveal many species not known to occur therein at present writing. Probably few new forms, however, will be added to the handful of brachiopods known from the Ellenburger group. Present knowledge of the occurrence of Lower Ordovician brachiopods in Texas is summarized below.

- Ellenburger group of central Texas
  - Tanyard formation (older)
    - *Finkelnburgia* cf. *F. macleodi* (Whitfield)
    - *Finkelnburgia helleri* Cloud, n. sp.
    - *Finkelnburgia obesa* Cloud, n. sp.
    - *Tetralobula texana* Ulrich and Cooper
    - *Syntrophina* sp.
  - Gorman formation (medial formation)
    - *Finkelnburgia* spp.
    - *Syntrophina campbelli* (Walcott)
    - *Diaphelasma oklahomense* Ulrich and Cooper
    - *Diaphelasma pennsylvanicum* Ulrich and Cooper
    - *Syntrophinella warreni* Cloud, n. sp.
  - Honeycut formation (younger)
    - *Finkelnburgia cullisoni* Ulrich and Cooper
    - *Finkelnburgia* spp.
    - *Xenelasma syntrophioides* Ulrich and Cooper (first occurrence in top surface of top bed of Gorman formation)
- Marathon limestone and Alsate shale of the Marathon Basin
    - "*Acrotreta*" sp. (King, 1937, p. 30)
    - "*Paterula*" sp. (King, 1937, p. 30)
    - "*Lingula*" sp.
    - *Orthis* sp.
    - *Diaphelasma* cf. *D. complanatum* Ulrich and Cooper
- El Paso formation of West Texas
  - Beach Mountain (north end)
    - *Archaeorthis costellata* Ulrich and Cooper
    - *Tetralobula* aff. *T. imbricata* Ulrich and Cooper
    - *Clarkella* sp.
    - *Syntrophina* sp.
    - *Syntrophina magna* Ulrich and Cooper
    - *Diaphelasma oklahomense* Ulrich and Cooper
    - *Xenelasma syntrophioides* Ulrich and Cooper
  - Diablo Plateau (between Cox Mountain and Black Knobs)
    - *Archaeorthis costellata* Ulrich and Cooper
    - *Nothorthis pennsylvanicum* Ulrich and Cooper
    - *Finkelnburgia cullisoni* Ulrich and Cooper
    - *Diaphelasma* sp.
    - *Xenelasma syntrophioides* Ulrich and Cooper
  - Hueco Mountains (sections at Old Padre Mine and Helm's West Well)

Archaeorthis costellata Ulrich and Cooper—very common
Finkelnburgia n. sp. aff. *F. skenidioides* Ulrich and Cooper
Tritoechia sp.
Polytoechia cf. *P. inaequistriata* Ulrich and Cooper
Polytoechia bella Cloud, n. sp.
Diaphelasma complanatum Ulrich and Cooper
Calliglypha miseri Cloud, n. sp.

Franklin Mountains (south end)

Nanorthis sp.
Archaeorthis costellata Ulrich and Cooper
Hesperonomia antelopensis Ulrich and Cooper
Hesperonomia sp.
Finkelnburgia cullisoni Ulrich and Cooper
Finkelnburgia cf. *F. skenidioides* Ulrich and Cooper
Finkelnburgia aff. *F. skenidioides* Ulrich and Cooper
Finkelnburgia spp.
Diparelasma typicum Ulrich and Cooper
Oligorthis arbucklensis Ulrich and Cooper
Tritoechia large sp.
Tritoechia small sp.
Polytoechia bella, Cloud, n. sp.
Syntrophina percarinata Cloud, n. sp.
Diaphelasma pennsylvanicum Ulrich and Cooper
Diaphelasma complanatum Ulrich and Cooper
Syntrophopsis praecursor Cloud, n. sp.
Syntrophopsis magna Ulrich and Cooper
Syntrophopsis cf. *S. obscura* (Hall and Whitfield) (Kirk, 1934, p. 448)

To the above may be added species of *Lingulepsis* and probably *Lingulella* from the basal Lower Ordovician Bliss sandstone of West Texas, and *"Orthis"* from the Alsate shale (King, 1937, p. 82).

The stratigraphic positions of the various brachiopods listed above are given by Cloud and Barnes (*in press*) and need not be repeated here, except as necessary under descriptions of the species and in the plate legends. In the report mentioned brachiopods are also included in faunal lists given in support of correlations with the Lower Ordovician of the Arbuckle and Wichita Mountains of Oklahoma and the Manitou formation of Colorado. It seems likely that most of the brachiopods from the Manitou and Arbuckle strata have been described, and many are listed by Ulrich and Cooper (1938) and by Decker (1939). A single new species, *Syntrophinella deckeri,* is here described from the Arbuckle strata; and the new species *Syntrophopsis praecursor,* described from the El Paso formation, is found also in the lower Manitou strata near Wellsville, Colorado.

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SYSTEMATIC DESCRIPTIONS

Except for those previously-named species that occur in the Ellenburger group only newly-named species are here discussed. Of the genera, only the new genus *Calliglypha* is described. Excellent illustrations and descriptions of other genera and species listed under *General remarks* have been published by Ulrich and Cooper (1938).

Percival (1944) has shown that dorsal and ventral as heretofore applied to the articulate brachiopods are the reverse of the embryonically dorsal and ventral positions. Therefore it seems advisable to return to the use of the formerly popular and more accurate terms *brachial* valve for the so-called *dorsal* valve and *pedicle* valve for the so-called *ventral* valve of brachiopods. Under this terminology it is occasionally awkward merely to substitute brachial for dorsal and pedicle for ventral, but felicitous expression may be obtained by a slight shift of words. It has proved convenient in the plate legends to describe as a *normal* view, a view essentially perpendicular to the general shell-surface of either valve. As a matter of convention it is preferable to continue orienting profile views of whole shells with the brachial valve toward the top of the plate.

Unless otherwise stated in the plate legends, the specimens figured are free silicified valves.[1]

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[1] All figured specimens are at the U. S. National Museum. Some unfigured paratypes are in the collections of the Texas Bureau of Economic Geology, and some at the Museum of Comparative Zoölogy, Harvard University.

Suborder ORTHOIDEA Schuchert and Cooper, 1932

Superfamily ORTHACEA Walcott and Schuchert, 1908

Family FINKELNBURGIIDAE Schuchert and Cooper, 1932

Genus FINKELNBURGIA (Walcott), 1905

As Ulrich and Cooper stated (1938, p. 131), "the species of *Finkelnburgia* . . . seem to form a composite group." Those considered in the present study may be divided into species having affinities with *F. cullisoni* and *F. skenidioides*, occurring in the higher Lower Ordovician strata, and those like *F. helleri*, *F. obesa*, and *F. bellatula*, which occur mostly in older rocks. The genotype, *F. finkelnburgi* (Walcott), internally resembles the first-mentioned group, but it is an Upper Cambrian species. Two or three genera may eventually be recognized in what is now called *Finkelnburgia;* but the genus as recognized is a useful group, even if composite, and its revision or permanent establishment as at present delimited is a problem best left for the future.

In addition to the species noted below several species of *Finkelnburgia* from the Gorman and Honeycut formations cannot be identified with described species and are not sufficiently well known to warrant description as new.

FINKELNBURGIA CULLISONI Ulrich and Cooper, 1936

(Pl. 1., figs. 1-4)

Finkelnburgia cullisoni Ulrich and Cooper, 1938, p. 136, Pl. 23C, figs. 18-26.

This distinctive large *Finkelnburgia* was confused with *Tritoechia* on a number of occasions during stratigraphic studies of the Ellenburger group. So far as is now known, however, *Tritoechia* does not occur in the Ellenburger.

F. cullisoni is known from a number of localities between 290 and 400 feet above the base of the Honeycut formation. Specimens from the following localities are illustrated:

16T-1-40A.[1] Upper part of Honeycut formation, 0.38 mile airline west-southwest of Cypress Mill, Blanco County, Texas.

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[1] Numbers such as this indicate localities of the Texas Bureau of Economic Geology, which uses a system in which each of the 254 counties of the State is numerically designated, with other parts of the number referring to location within the county. Numbers preceded by TF-, OF-, and CF- are field-locality numbers given by Cloud to collections of fossils from Texas, Oklahoma, and Colorado made for the U. S. Geological Survey and housed at the U. S. National Museum.

16T-2-42G. About 390 feet above base of Honeycut formation, 5 miles airline east of Johnson City, near center of Honeycut Bend of Pedernales River, Blanco County, Texas.
27T-9-44D. Approximately 297 feet above base of Honeycut formation, 2 miles west of Longhorn Cavern, Burnet County, Texas.
27T-9-44B. About 396 feet above base of Honeycut formation, 2 miles west of Longhorn Cavern, Burnet County, Texas.

FINKELNBURGIA HELLERI Cloud, spec. nov.

(Pl. 1, figs. 19-32, 36)

Description. Shell large for the genus, wider than long, multicostellate. Cardinal extremities ordinarily either right angles, with width at the cardinal margin and midlength subequal; or slightly alate or obtuse. Surface costellae unequal and variable in width, commonly with groups of finer costellae separated by coarser ones; increasing in number by bifurcation and perhaps also by implantation. In some specimens pronounced growth lines combine with the costellae to produce a cancellate pattern. The proportion of such specimens varies between localities, ranging from an inconspicuous to a large fraction.

Pedicle valve moderately convex in lateral profile, less convex in end profiles; full at the middle but with gently convex posterolateral slopes.

Brachial valve gently convex in all profiles, grading to almost flat in some specimens. A shallow sulcus is consistently present, ranging from broad to narrow, and commonly prominent.

Interior as in *F. buttsi* Ulrich and Cooper and *F. bellatula* Ulrich and Cooper. The brachial valve commonly displays four prominent, raised adductor muscle-scars as in *Tetralobula.* Cardinal process inconspicuously linear, or absent.

	Length mm.	Width at midlength mm.	Width at hinge mm.	L/W
Holotype brachial valve (TF-229)	8.5	11.8	11.3	0.72
Figd. brachial valve (TF-229)	9.7	13.4	12.7	0.72
Figd. brachial valve (TF-409)	8.9	12.5	——	0.71
Figd. pedicle valve (TF-409)	9.4	11.5	11.7	0.80
Figd. pedicle valve (TF-229)	8.5	10.2	9.8	0.83

Material. The holotype brachial valve and many paratype valves are from locality TF-229; about 30 to 50 feet above base of Tanyard formation, in calcitic facies of Threadgill member, and 4250 feet airline

N.67°W. from U. S. Highway 87 at north abutment of bridge over San Saba River, McCulloch County, Texas.

Many additional paratypes are from locality TF-409; about 20 feet above base of Tanyard formation, in calcitic facies of Threadgill member, and 3300 feet airline N.40°W. from U. S. Highway 87 at midlength of bridge over San Saba River, McCulloch County, Texas.

Other specimens are from various localities low in the Tanyard formation of the western part of the Llano uplift.

Discussion. F. helleri differs from most species of *Finkelnburgia* in its nearly right-angled cardinal extremities and its large size. It has its closest resemblances with *F. buttsi* Ulrich and Cooper and *F. bellatula* Ulrich and Cooper, and when the final study was made I found that I had previously referred specimens to both of these species.

F. buttsi. however, is a more consistently alate, a more transverse, and a more commonly reticulate shell of smaller average size than is *F. helleri. F. bellatula* is a less transverse and more weakly ornamented shell than *F. helleri.* In morphogeny, as shown by growth-lines, the similarity is greater between *F. buttsi* and *F. helleri.*

FINKELNBURGIA OBESA Cloud, spec. nov.

(Pl. 1, figs. 8-18)

Description. Shell fairly large for the genus, slightly wider than long, with greatest width at midlength, and with obtusely angular cardinal extremities. Subequally biconvex, with pedicle valve the deeper, but with both valves of strong convexity for the genus. Convexity greatest at the middle, and least on the posterolateral slopes. Multicostellate with costellae unequal and variable in breadth. A variable number of finer costellae are separated by coarser ones, and they increase in number mainly by bifurcation.

The brachial valve lacks a fold, and is evenly and moderately convex.

Internal features similar to those of *F. helleri,* but with adductor muscle scars of brachial valve not so prominent.

	Length mm.	Width at midlength mm.	Width at hinge mm.	Depth mm.	L/W
Figd. brachial valve (TF-174)	8.9	10.3	8.1	2.6	0.86
Holotype pedicle valve (TF-175)	8.8	9.8	9.6	3.1	0.90

Material. The holotype pedicle valve and 17 paratype valves are from locality TF-175; top of Threadgill member (in calcitic facies) of Tanyard formation, 7600 to 7700 feet north from Bear Spring, which is itself 13.8 miles by speedometer southwest of Mason, Mason County, Texas.

Thirty-two paratype valves are from locality TF-174; approximately 15 feet below top of Threadgill member (in calcitic facies) of Tanyard formation, 6500 to 6600 feet N.6°W. from Bear Spring, Mason County, Texas.

Twenty-five paratype valves are from locality TF-196; measured as 285.5 feet above base of Tanyard formation, near top of Threadgill member (calcitic facies), south bank of Llano River downstream from Pete Hollow, Mason County, Texas.

Eleven paratype valves are from locality TF-178; about 250 feet above base of Tanyard formation, near top of Threadgill member (calcitic facies), 6500 feet S.81°W. from Bear Spring on south side of Llano River, Mason County, Texas.

Discussion. F. obesa is distinct from previously described species of *Finkelnburgia* in the relatively strong convexity of both its valves, and in the absence of a sulcus on the brachial valve. It most nearly resembles *F. wemplei* (Cleland), especially in general shape and features of the ribbing. *F. obesa,* however, is not so markedly subcircular as is *F. wemplei,* and it contrasts further with the latter in its lack of a sulcus on the brachial valve and in its larger size. The absence of a brachial sulcus, and the flattened posterolateral slopes of the pedicle valve serve to distinguish *F. obesa* from *F. pauciradiata* Ulrich and Cooper.

FINKELNBURGIA cf. F. MACLEODI (Whitfield)

(Pl. 1, figs. 5-7)

Orthis macleodi Whitfield, 1889, Am. Mus. Nat. Hist., Bull., **2**, p. 43, Pl. 7, figs. 1-4.

Orthis macloedi Whitfield. Lesley, 1889, Pennsylvania Geol. Survey **(2)**, Rept. P4, p. 523.

Finkelnburgia ? macleodi (Whitfield). Ulrich and Cooper, 1938, p. 138, Pl. 24, fig. 6.

This small, depressed shell was found only at locality TF-224, measured as 238 feet above base of Tanyard formation, in upper part of Threadgill member (calcitic facies); south bank of Llano River downstream from Pete Hollow, Mason County, Texas.

The types of *F. macleodi* were not examined by me, but the figure by Ulrich and Cooper of the syntype pedicle valve seems very like the specimen represented by figure 6 of Plate 1 in the present paper.

The complete, exfoliated pedicle valve here figured measures 5.4 mm. wide and 4.2 mm. long, the brachial valve 7.1 mm. wide and 4.1 mm. long.

Suborder CLITAMBONOIDEA Opik, 1934

Superfamily CLITAMBONACEA Schuchert, 1929

Family POLYTOECHIIDAE Öpik, 1934 (emended)

Genus POLYTOECHIA Hall and Clarke, 1892

POLYTOECHIA BELLA Cloud, spec. nov.

(Pl. 1, figs. 33-35, 37-46; Pl. 2, figs. 1-9)

Description. Shell small for the genus; subcircular in outline when viewed from pedicle side; unequally biconvex, with pedicle valve the deeper. Greatest width of shell at midlength. Shell delicately ornamented by narrow costellae that increase in number by implantation and probably by bifurcation. Commonly these costellae are so obscured by silicification features that the shell appears to be smooth, but a coating of ammonium chloride and oblique lighting ordinarily shows them up.

Pedicle valve subhemiconical; with prominent, high, subplane, apsacline interarea commonly inclined but a few degrees posterior to the vertical. Delthyrium closed by a convex xenidium. Foramen apical or subapical. Convexity of valve strong and fairly even, sulcus absent.

Brachial valve moderately and evenly convex, transverse in outline. Adductor tracks in posterolateral and anteromedian pairs, diverging slightly toward the anterior, as in species of *Tritoechia.*

	Length mm.	Width at midlength mm.	Width at hinge mm.	Depth mm.	L/W
Figd. brachial valve (TF-346)	6.8	8.8	7.7	2.2	0.77
Brachial valve of holotype (TF-346)	5.6	6.8	5.9	3.9	0.82
Pedicle valve of holotype (TF-346)	6.2	6.8	5.9	3.9	0.91
Figd. pedicle valve (TF-346)	7.6	8+	7.6	3.8	0.95
Figd. pedicle valve (TF-347)	8.5	8.5	6.9	4.7	1.00

Material. The holotype, an immature whole shell, and 47 paratype valves are from locality TF-346; about 205 to 210 feet below top of El Paso formation, Hueco Mountains, north of Helm's West Well, El Paso County, Texas.

Three paratype pedicle valves are from locality TF-347; about 4 feet stratigraphically above TF-346, in the same section.

Thirty-three unfigured paratype valves are from locality TF-361; about 600 feet below top of El Paso formation, southwest side of McKelligon Canyon above El Paso City Park, Franklin Mountains, El Paso County, Texas.

Thirteen paratype valves are from locality TF-450; about 1010 feet above base and 580 feet below top of El Paso formation in section at south end of Franklin Mountains, city limits of El Paso, Texas.

Discussion. In its small size alone *P. bella* is distinct from adults of all described species except *P. apicalis* (Whitfield), and *P. fillistriata* (Butts), and from both of these it differs in its finer, more widely spaced, and more inconspicuous ornamentation. The brachial valve of *P. bella* is less convex, and its cardinal margin straighter than most representatives of the genus. Moreover *P. bella* displays neither sulcus on the pedicle valve nor fold on the brachial valve.

The internal features of the genus, hitherto incompletely known, are well displayed by the free silicified shells of *P. bella*. The structure and musculature of the brachial valve is very like that of *Tritoechia*, except that a cardinal process is rarely developed.

The spondylium triplex of the pedicle valve varies, in specimens out of the same small piece of rock, from a structure above and free from the floor of the valve to one that is quite sessile, although never so strongly fused with the floor of the valve as is habitual in other genera of the family. For this reason the subfamily distinctions of Ulrich and Cooper (1938) are not here recognized, and *Polytoechia* is included with *Tritoechia* and *Pomatotrema* in the undivided family Polytoechiidae, referred to Öpik. Öpik in 1934 (p. 76) had placed *Polytoechia* in the subfamily Polytoechiinae under Estlandiidae and had set up also (p. 77) the family Deltatretidae, with *Deltatreta* and *Pomatotrema.* Ulrich and Cooper showed that *Deltatreta-Polytoechia*, and set up Tritoechiidae to include *Tritoechia*, *Polytoechia*, and *Pomatotrema* in two subfamilies. In view of the recommendations given under article 5 of the International Rules of Zoological Nomenclature, it seems to the writer better to recognize Polytoechiidae as the family name, emended to conform to the diagnosis of the Tritoechiidae as given by Ulrich and Cooper.

Suborder SYNTROPHIOIDEA Ulrich and Cooper, 1936

Family TETRALOBULIDAE, Ulrich and Cooper, 1936

Genus TETRALOBULA Ulrich and Cooper, 1936

TETRALOBULA TEXANA Ulrich and Cooper, 1938

(Pl. 2, figs. 15-16, 21-22)

As this species was based on specimens from central Texas its identification in that region is certain. The syntypes are reillustrated and the reader is referred to the original description. The syntypes are from the lower beds of the Tanyard formation (Threadgill member, calcitic facies), 4250 feet west-southwest of the ford at the Blockhouse Ranch, on the south bank of San Saba River, northwestern Mason County.

The species is now known from several other localities in the western part of the Llano uplift, and its range appears to be from 40 to 60 feet above the base of the Tanyard formation, which is the Cambrian-Ordovician boundary. In their final report on the Ellenburger group Cloud and Barnes (*in press*) cite the occurrence of *T. texana* in measured sections along Threadgill Creek in Gillespie County and Llano River in Mason County.

Family CLARKELLIDAE Schuchert and Cooper, 1932

Genus SYNTROPHINA Ulrich, 1928

In addition to the species mentioned below, a *Syntrophina* of uncertain specific affinities has been found near the middle of the Tanyard formation, in the Llano region.

SYNTROPHINA CAMPBELLI (Walcott)

(Pl. 2, figs. 10-13, 17)

Syntrophia campbelli Walcott, 1908, Smithsonian Institution, Misc. Coll., 53, p. 107-108, Pl. 10, figs. 9-9c.

Syntrophia campbelli Walcott. Walcott, 1912, U. S. Geol. Survey, Mon. 51, p. 801, fig. 73.

Syntrophina campbelli (Walcott). Ulrich and Cooper, 1938, p. 218, Pl. 46, figs. 19-34.

The specimens here assigned to *S. campbelli* are so closely similar to Walcott's type specimens that they could not be separated from the type lot if both were unmarked.

The species is common at several localities in central Texas, especially in the western part of the Llano uplift where it ranges from about 30 to 110 feet above the base of the Gorman formation. This suggests that the zone of its occurrence in Missouri may actually belong in the lower part of the Roubidoux formation as maintained by workers previous to Ulrich and Cooper.

Localities from which specimens are figured are as follows:

Bridge loc. 50. Within 50 feet of base of Gorman formation, about 3000 feet north of entrance to Flying-V Ranch, on east side of Texas State Highway 16, San Saba County, Texas.

TF-171. Estimated as 70 to 90 feet above base of Gorman formation, 6100 to 6200 feet airline S.40°W. from Bear Spring, which is itself 13.8 miles by speedometer southwest of Mason, Mason County, Texas.

TF-170. Estimated as 90 to 110 feet above base of Gorman formation, about 3800 feet S.25°W. from Bear Spring, Mason County, Texas.

SYNTROPHINA MAGNA Ulrich and Cooper, 1938

(Pl. 2, figs, 14, 18-19)

Syntrophina magna Ulrich and Cooper, 1938, p. 221-222, fig. 6c; Pl. 47, figs. 14-15.

Six specimens here assigned to *S. magna* were obtained from locality TF-316, about 91 feet above base of El Paso formation in section at north end of Beach Mountain, 11 miles north of Van Horn, Culberson County, Texas.

They are morphologically very similar to the type specimens, although the larger specimens of the type lot are almost one-third again as big as the most complete specimens from Beach Mountain.

SYNTROPHINA PERCARINATA Cloud, spec. nov.

(Pl. 2, figs. 20, 23-31)

Description. Shell large for the genus; wider than long in adult specimens, in some instances grading to a little longer than wide in immature shells. Fold of brachial valve sharp and prominent anteriorly, fading out or giving way to a shallow and inconspicuous sulcus in the posterior third of the valve. Sides of brachial valve strongly and evenly convex. Sulcus of pedicle valve deep and fairly broad, with median portion a sharply depressed line, becoming inconspicuous or fading out in umbonal region.

Internal features well marked, structurally according to the pattern for the genus. Impressions of adductor muscles in posterior and anteromedian pairs.

	Length mm.	Width at midlength mm.	Width at hinge mm.	Depth mm.	L/W
Holotype brachial valve (TF-354)	10.8	15.4	8.5	10.5	0.70
Brachial valve of immature paratype (TF-354)	9.7	10.8	5.9	7.2	0.90
Pedicle valve of above (TF-354)	11.1	10.8	5.9	7.2	1.03

Material. The holotype brachial valve and 35 paratype valves are from locality TF-354, approximately 405 feet above base of El Paso formation in section at south end of Franklin Mountains, city limits of El Paso, Texas.

Discussion. *S. percarinata* is most similar to *S. carinifera* Ulrich and Cooper, by reason of the extremely sharp fold and sulcus peculiar to these two species. The posterolateral slopes of the brachial valve of *S. percarinata*, however, are fuller than are those of *S. carinifera*, and there is less foresweep to the posterolateral margins. In the pedicle valve of *S. carinifera* the posterolateral slopes pitch steeply toward the valve-margin, resulting in a pair of prominent carinae between the sides and the sulcus; but in the species here described the posterolateral slopes of the pedicle valve fall rather gently to the posterior margins and do not define carinae with the sulcus—they are quite gently convex, to almost flat. Shells of *S. percarinata* are also consistently larger than those of *S. carinifera*, and they have proportionately wider hinge-lines than the latter.

Genus DIAPHELASMA Ulrich and Cooper, 1936

DIAPHELASMA OKLAHOMENSE Ulrich and Cooper, 1938

(Pl. 3, figs. 1-27)

Diaphelasma oklahomense Ulrich and Cooper, 1938, p. 226, Pl. 50A, figs. 1-7.

Study of large suites of specimens from several localities in the Arbuckle and Wichita Mountains of Oklahoma (OF-4, 5, 5a) and comparison of them with the type specimens of *D. oklahomense* indicates the latter to have a less well developed fold on the brachial valve than is normal for the species,to be slightly undersized, and to be slightly divergent in other particulars from the norm for the species. Fairly large suites of specimens from Texas show essentially the same range of size, shape, proportions, and features of fold and sulcus as do those from Oklahoma.

The specimens from Texas show some tendency to have nearly flat postero-lateral slopes in the pedicle valve, whereas the corresponding slopes in those from Oklahoma tend to be gently convex. This distinction is not consistent, however, apparently being only a geographic variation in tendency.

Specimens collected by Josiah Bridge and G. A. Cooper from a point about 100 feet above the base of the El Paso formation in the Beach Mountain section (Pl. 3, figs. 3-9) are here referred to *D. oklahomense* with reservations. Although generally similar to topotype examples of *D. oklahomense,* they are intermediate in size between it and *D. pennsylvanicum,* and they also have some resemblance to the syntypes of the latter. Possibly the two species may have to be merged, although as recognized in central Texas they hold distinct and separate stratigraphic positions.

Specimens figured are from the following localities:

TF-316. About 91 feet above base of El Paso formation in section at north end of Beach Mountain, 11 miles north of Van Horn, Culberson County, Texas.

16T-2-42C. Measured as 86 feet below top of Gorman formation in section at Honeycut Bend of Pedernales River, about 4.5 miles east of Johnson City, Blanco County, Texas.

16T-2-41A. Approximately same stratigraphic position as 16T-2-42C, north from it, in northern part of Honeycut Bend.

A fourth lot from about 100 feet above base of El Paso formation in same section as TF-316. Collected by Josiah Bridge and G. A. Cooper, 1939. Compare with *D. oklahomense.*

DIAPHELASMA PENNSYLVANICUM Ulrich and Cooper, 1938

(Pl. 3, figs. 28-48)

Diaphelasma pennsylvanicum Ulrich and Cooper, 1938, p. 226-227, Pl. 49, figs. 1-25 (especially figs. 17-20, 22-25).

Specimens here referred to *D. pennsylvanicum* are virtually identical with specimens from Virginia that are referred to *D. pennsylvanicum* by Ulrich and Cooper. Adult specimens from Virginia and Texas are consistently of about the same size and shape, but they are consistently larger than the syntype lot from Pennsylvania.

As Ulrich and Cooper appear to have done, I have considered that the larger specimens might be specifically distinct from the type lot; but if they are, the only consistent distinction evident at present writing is one of adult size, and it appears advisable on final consideration to consider the two groups as conspecific unless larger collections of *D. pennsylvanicum* from other localities in the vicinity of the syntype lot reveal valid distinctions. It is possible that analysis of large suites of specimens might advise merging *D. pennsylvanicum* and *D. oklahomense*, perhaps with recognition of a new species to include the shells from Texas and Virginia that are now referred to *D. pennsylvanicum.*

Illustrated specimens are from the following localities:

TF-251. About 60 feet below top of Gorman formation, 2400 feet N.65°W. from Gorman Falls, southeastern San Saba County, Texas.

16T-2-42E Measured as 46 feet below top of Gorman formation in section at Honeycut Bend of Pedernales River, about 4.5 miles east of Johnson City, Blanco County, Texas.

TF-353. Approximately 350 to 355 feet above base of El Paso formation in section at south end of Franklin Mountains, city limits of El Paso, Texas.

Genus SYNTROPHINELLA Ulrich and Cooper, 1934

SYNTROPHINELLA DECKERI Cloud, spec. nov.

(Pl. 4, figs. 1-7)

Description and comparison. *S. deckeri* resembles *S. typica* and *S. warreni* and differs from other described species of *Syntrophinella* in its ornamentation, which consists of very fine radial costellae. It resembles *S. warreni* and differs from *S. typica* in the fact that the fold on the brachial valve and sulcus on the pedicle valve are absent or inconspicuous in the umbonal regions, although sharp and prominent at the front of the shell. *S. deckeri* differs from both *S. warreni* and *S. typica* in that its outline tends to be subcircular, and its hinge-line is proportionally much narrower than in either of these species.

	Length mm.	Width at midlength mm.	Width at hinge mm.	Depth mm.	L/W
Holotype brachial valve (OF-4)	6.6	8.2	5.2	3.3	0.80
Figd. pedicle valve (OF-4)	6.4	8.4	5.1	2.5	0.76

Material. The holotype and 30 paratypes are from locality OF-4, near middle of Cool Creek formation (estimated 530 to 550 feet below top) and 5 to 15 feet above a prominent breccia-zone: SW1/4, SW1/4 sec. 18, T.2 S., R.2 E.; about 1400 feet west of U. S. Highway 77, Arbuckle Mountains, Murray County, Oklahoma.

SYNTROPHINELLA WARRENI Cloud, spec. nov.

(Pl. 4, figs. 8-15)

Description and comparison. S. warreni resembles *S. typica* Ulrich and Cooper in size, ornamentation, and general shape, but differs from it in features of the fold, sulcus, and cardinal margin.

In *S. warreni* the fold of the brachial valve is broad and fairly high at the front, inconspicuous or absent in the posterior third of the shell. The sulcus of the pedicle valve is broad and deep at the front, absent or inconspicuous in the posterior third of the shell. In contrast to *S. warreni* shells of *S. typica* have a more prominent fold and sulcus, continuing to the posterior margin. As far as may be judged from the few specimens at hand, *S. typica* tends to have a shorter hinge-line, more pronounced convexity, and more rounded lateral margins than does *S. warreni.* In the latter features, however, the two forms range through approximately similar sequences in variation, and the principal distinction between them is the relative development of fold and sulcus.

	Length mm.	Width at midlength mm.	Width at hinge mm.	Depth mm.	L/W
Holotype brachial valve (205T-1-20A)	6.5	9.8	8.0	2.3	0.66
Figd. brachial valve (TF-250)	7.2	9.5	7.4	3.4	0.77
Figd. pedicle valve (205T-1-20A)	7.4	9.4	7.6	3.0	0.79

Material. The holotype brachial valve and 18 paratype valves are from locality 205T-1-20A, chert a few feet above zone of *Archaeoscyphia* at middle of Gorman formation, 1.8 miles south of Gorman Falls, southeastern San Saba County, Texas.

Fourteen paratypes are from locality TF-250, in chert about 220 feet below top of Gorman formation, immediately above zone of *Archaeoscyphia,* 400 to 450 feet west of lip of Gorman Falls, in southeastern San Saba County, Texas.

S. warreni is also known from several other localities in central Texas, all in the stratigraphic vicinity of the zone of *Archaeoscyphia* at the middle of the Gorman formation.

CALLIGLYPHA Cloud, gen. nov.

(Gr., *kalos,* beautiful; *glypho,* engrave)

Description. Shell small, syntrophoid, with fold on brachial valve and sulcus on pedicle valve. Interarea of pedicle valve rather wide and high for the size of the shell, apsacline; delthyrium wide and open. Interarea of brachial valve short and narrow. Surface elegantly ornamented radially and concentrically. This ornamentation consists of fine radial costellae that tend to break up into rows of small nodes or short spines, situated on narrow concentric crenulations in such a manner that the pattern is cancellate and nodose.

Pedicle valve with spondylium simplex supported by a prominent median septum about half as long as the valve. A pallial trunk arises on either side of the median septum as a broad depression, the pair diverging as they extend anteriorly. In the brachial valve the brachiophore plates are short and widely divergent, as in *Diaphelasma,* and also as in that genus are separated by a low but prominent collar-like callosity at the posterior margin where the diductor muscles were situated. Marks left in brachial valve by adductor muscles are in elongate anteromedial and posterolateral pairs. Two major pallial trunks arise on either side of the brachial valve, in the umbonal region and diverge from their opposites as they extend anteriorly.

Genotype and only known species. Calliglypha miseri Cloud, n. sp.

Stratigraphic and geographic range: At present known only from locality TF-347, 200 feet below top of El Paso formation, section north of Helm's West Well, Hueco Mountains, El Paso County, Texas. The sequence of fossils in the strata above and below locality TF-347 shows it to be in rocks of post-Honeycut and pre-Black Rock age, perhaps homotaxially equivalent to the Smithville formation of the Ozark region.

Discussion. Internally *Calliglypha* is like *Diaphelasma,* although the brachiophore plates of *C. miseri* are even shorter and more widely divergent than in typical *Diaphelasma*. *Calliglypha*, however, is an intricately ornamented shell, whereas *Diaphelasma* is smooth. *C. miseri* is also proportionately more transverse than known species of *Diaphelasma;* and, in contrast to the short-hinged *Diaphelasma*, the width of its cardinal margin is almost as great as the greatest width. *Calliglypha* might thus be characterized as a wide-hinged, highly ornamented, stratigraphically high outgrowth of the *Syntrophina-Diaphelasma* stock, with internal resemblance to *Diaphelasma*.

Externally *Calliglypha* suggests *Glyptotrophia*, but the internal features of *Glyptotrophia* are those of the family Huenellidae. It also resembles *Stichotrophia* Cooper, a related clarkellid. But *Stichotrophia* has the interior of its pedicle valve more like that of *Syntrophina* than *Diaphelasma*, and its cancellate ornamentation differs from that of *Glyptotrophia* in not giving rise to nodes or spines at the intersection of costellae with concentric crenulations. The medium septum in the pedicle valve of *Stichotrophia* is shorter and lower than is that of *Calliglypha;*and its spondylium is sessile at the posterior end, whereas that of *Calliglypha* is free for its full length and well above the floor of the valve.

CALLIGLYPHA MISERI Cloud, spec. nov.

(Pl. 2, figs. 32-45)

Description. The only species of *Calliglypha* at present known is a small, transverse, subequally biconvex, intricately ornamented, syntrophoid shell with a broad and shallow sulcus on the pedicle valve and a broad and low fold on the brachial valve. The fold begins not far anterior to the brachial umbo, but the sulcus is normally not much over half the length of the shell, or even less than half its length. The convexity is fairly strong in both valves and, although rather evenly distributed, strongest in the lateral portions of the pedicle valve, which are fully rounded.

The concentric ridges that interrupt the fine costellae, and on which the resulting nodes or spines are located, are narrow and are separated by concentric depressions of about equivalent width. The costellae or radial lines of nodes or short spines are spaced about as closely as the concentric ridges, so that the resulting cancellate pattern tends to be a net of small squares, with the nodes or spinules quincunxially arranged.

Other characters as described for the genus. Being the only species in the genus comparison is not feasible.

	Length mm.	Width at midlength mm.	Width at hinge mm.	Depth mm.	L/W
Holotype brachial valve	5.6	10±	9.6	3.0	0.56
Paratype pedicle valve	5.8	7.8	6.5	2.9	0.74
Paratype pedicle valve	4.5	6.9	6.3	2.9	0.65

Material. Description based on holotype brachial valve, a second fragment of a brachial valve, 5 fairly complete paratype pedicle valves (3 figured) and 3 fragments of pedicle valves. All from locality TF-347, 200 feet below top of El Paso formation, section north of Helm's West Well, Hueco Mountains, El Paso County, Texas.

Family SYNTROPHOPSIDAE Ulrich and Cooper, 1936

Genus SYNTROPHOPSIS Ulrich and Cooper, 1936

SYNTROPHOPSIS PRAECURSOR Cloud, spec. nov.

(Pl. 4, figs. 16-26)

Description and comparison. In external features *S. praecursor* differs from previously described species except *S. transversa* in its proportionately long hinge-line, generally inconspicuous fold and sulcus, and the relatively depressed profile of its biconvex shell. *S. transversa* differs from the species here named in its conspicuously transverse outline, and relatively longer hinge-line.

Internally *S. praecursor* shows plainly the structural features that characterize *Syntrophopsis*, but the spondylium is more markedly sessile in the new species than any previously described. In this connection it is of interest to note that the shell showing this feature is not a very late, but rather an early representative of *Syntrophopsis*, occurring in strata of Gorman (equivalent to Roubidoux) age.

The holotype pedicle valve is about 10 mm. long, 11 mm. wide at the midlength, and 9 mm. wide at the hinge-line. The ratio of width to length is thus about 0.91.

Occurrence. Holotype and 6 incomplete paratype valves from locality TF-360, estimated to be about 440 feet above base of El Paso formation in upper part of Gorman faunal equivalent, section on southwest side of McKelligon Canyon, above El Paso City Park, Franklin Mountains, El Paso County, Texas.

Fifteen specimens from locality CF-1, about 20 feet above lowest exposures and near base of Manitou formation in section on south side of U. S. Highway 50 in gorge of Arkansas River, just west of Chaffee-Fremont County line and the town of Wellsville, Chaffee County, Colorado.

Family SYNTROPHIIDAE Schuchert, 1896

Subfamily XENELASMINAE Ulrich and Cooper, 1936

Genus XENELASMA Ulrich and Cooper, 1936

XENELASMA SYNTROPHIOIDES Ulrich and Cooper, 1936

(Pl. 4, figs. 27-37)

Xenelasma syntrophioides Ulrich and Cooper, 1938, p. 244, Pl. 55, figs. 17-30.

Fortunately the specimens of *X. syntrophioides* from Texas occur both as impressions in chert and as silicified free valves in limestone, the latter displaying the features of genus and species in good fashion and the former facilitating comparison with the syntypes, which are also chert-impressions.

Comparison of the Texas specimens with the types shows the same range of variation in both and reveals no consistent distinction between them.

The complete specimen illustrated by figures 31-34 of Plate 4 has a brachial valve 6.0 mm. long, a pedicle valve 6.6. mm. long, a width of 7.9 mm. at midlength, a hinge-width of 4.2 mm., and a thickness of 4.8 mm. The ratio of width to length is 0.76 for its brachial valve and 0.84 for the pedicle valve.

Illustrated specimens are from the following localities:

TF-127. Top surface of top bed of Gorman formation (= base of Honeycut formation), 4.26 miles airline S.55°E. from intersection of highways at San Saba, San Saba County, Texas.

TF-140. Same stratigraphic position as above, 3.54 miles airline S.9.5°W. from intersection of highways at San Saba, San Saba County, Texas.

TF-378. About 10 feet above base of Honeycut formation in measured section near Warren Springs, Riley Mountains, just south of a fence at the crest of a ridge west of a point on the Llano-Click road about 14 miles by speedometer southeast of Llano, Llano County, Texas.

TF-238. Lower beds of Honeycut formation, approximately 2.25 miles N.71°W. from Honey Creek School, and 100 feet south of Honey Creek on a wood road; about 9 miles airline S.40°E. from the center of Llano, Llano County, Texas.

X. syntrophioides is a common fossil at many localities in central Texas, where it characterizes the lower 140 feet of the Honeycut formation. Its actual lowest-known occurrence is at the top surface of the top bed of the Gorman formation, for it lived at the floor of the initial Honeycut sea. The stratigraphic occurrence of *X. syntrophioides* in Texas suggests that the chert from which its syntypes were obtained, instead of being of Longview age (Ulrich and Cooper, 1938, p. 244), may actually have been derived from lower Newala strata.

SELECTED REFERENCES

CLOUD, P. E., JR. and BARNES, V. E. (1946) *The life and environment of the early Ordovician sea in central Texas,* Rept. of Committee on Marine Ecology as related to Paleont., 1945-46, no. 6, p. 87-101, fig. 1.

.... (*in press*) *The Ellengurger group of central Texas,* Bureau of Economic Geol., Univ. of Texas Publ. 4621.

.... and BRIDGE, JOSIAH (1945) *Stratigraphy of the Ellenburger group in central Texas—a progress report,* Bureau of Economic Geol., Univ. of Texas Publ. 4301, p. 133-161, Pls. 1-10.

DECKER, C. E. (1939) *Progress report on the classification of the Timbered Hills and Arbuckle groups of rocks, Arbuckle and Wichita Mountains, Oklahoma,* Oklahoma Geol. Survey, Circ. No. 22.

KING, P. B. (1937) *Geology of the Marathon region, Texas,* U. S. Geol. Survey, Prof. Paper 187.

KIRK, EDWIN (1934) *The Lower Ordovician El Paso limestone of Texas and its correlatives,* Am. Jour. Sci., vol. 28, p. 443-463.

ÖPIK, A. (1934) *Über Klitamboniten,* Univ. Tartu, Publ. Geol., Inst., No. 39, text figs. 1-55, Pls. 1-48.

PERCIVAL, E. (1944) *A contribution to the life history of the brachiopod Terebratella inconspicua Sowerby,* Roy. Soc. New Zealand, Trans., vol. 74, pt. 1, p. 1-23, figs. 1-4.

ULRICH, E. O. and COOPER, G. A. (1938) *Ozarkian and Canadian Brachiopoda,* Geol Soc. Am., Special Paper 13.

No. 6.—*A New Genus of Brachiopoda from the Longview Limestone of Virginia* [1]

by

G. Arthur Cooper

The description and illustrations of the new Lower Ordovician brachiopod *Stichotrophia* have been in the files of the writer for some time, awaiting the accumulation of sufficient correlative material to warrant preparation of a plate of illustrations.

Space being available for illustrations of *Stichotrophia* on Plate 4 of the preceding paper, it and its genotype, *S. lamellata* Cooper, n. sp., are described below.

Genus STICHOTROPHIA Cooper, gen. nov.

Of moderate size, long interareas on both valves; syntrophoid in outline and profile; surface strongly lamellose, and lamellae ornamented by distant costellae. Interior of pedicle valve with spondylium sessile at posterior but supported by a low septum anteriorly. Interior of brachial valve resembling *Syntrophina;* with strong, subparallel, brachiophore supporting plates and transverse callosity for attachment of diductor muscles.

Genotype. Stichotrophia lamellata Cooper, spec. nov.

Discussion. The internal features of the brachial valve of this genus relate it to *Diaphelasma*, *Syntrophina*, *Syntrophinella*, and *Calliglypha*. The generic difference from all except *Calliglypha* is found in the costellate lamellose exterior ornamentation. From *Calliglypha* it differs in having the internal structures of the brachial valve more like those of *Syntrophina* than *Diaphelasma* and in not developing nodes or spines at the intersection of its radial costellae and concentric crenulations.

STICHOTROPHIA LAMELLATA Cooper, spec. nov.

(Pl. 4, figs. 38-44)

Biconvex, with long interareas on both valves, the one of the pedicle valve slightly longer than that of the brachial valve; sides gently curved; front margin truncated. Surface strongly lamellose. Pedicle valve with deep and broad median sulcus originating about 4 mm. anterior to the beak and occupying about half the width at the front. Tongue long, bluntly pointed. Flanks bounding sulcus very gently convex, with moderately steep slopes to the cardinal extremities but with steep lateral and anterolateral slopes.

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[1] Published by permission of the Secretary of the Smithsonian Institution.

Brachial valve with narrowly rounded to subcarinate fold much elevated above the flanks, which are slightly swollen.

Measurements. Pedicle valve 11 mm. wide, 9.8 mm. long; brachial valve 8 mm. long and 12.7 mm. wide.

Holotype. U. S. N. M. 108207a; paratypes, U. S. N. M. 180207b, c; unfigured paratypes U. S. N. M. 108207d-h.

Horizon and locality. Lower Ordovician (Longview limestone, 1000 feet below *Ceratopea)* at the bend of the road 3 miles northwest of Middletown on the road to Marlboro, Middletown Quadrangle, Virginia, associated with *Finkelnburgia virginica* Ulrich and Cooper.

Discussion. No other known species of this genus exists with which *S. lamellata* can be compared. Occurring with it is an undescribed species of *Tetralobula* with which it might be confused, but *Tetralobula* generally can be distinguished by its fine continuous costellae and the short brachial lamellae.

PLATES

PLATE 1[1]

FINKELNBURGIA and POLYTOECHIA[2]

Figure Page

1-4. *Finkelnburgia cullisoni* Ulrich and Cooper......................

(1) Plasticene replica of exterior of incomplete pedicle valve (x1) from locality 27T-9-44B, about 396 feet above base of Honeycut formation.

(2) Incomplete pedicle valve (x2) showing partial impression of interior, from locality 16T-2-42G, about 390 feet above base of Honeycut formation.

[1] **Plate inadvertently reduced in duplication and all magnifications 0.9x those given.**

[2] Localities referred to by number only in the plate legends are described in the text. On the plate legends it may be assumed that the locality is in Texas unless stated otherwise.

Figure Page

(3) Plasticene replica of interior of fragmentary pedicle valve (x2) from locality 16T-1-40A, upper part of Honeycut formation. **(4)** Interior of fragment of incomplete pedicle valve (x1) from locality 27T-9-44D, about 297 feet above base of Honeycut formation.

5-7. *Finkelnburgia* cf. *F. macleodi* (Whitfield)......................

Impression of interior of pedicle valve (x3), exfoliated pedicle valve (x3), and plasticene replica of brachial valve (x2) from locality TF-244, measured as 238 feet above base of Tanyard formation.

8-18. *Finkelnburgia obesa* Cloud, n. sp.............................

(8-12) Normal and anterior views (x2) of chert-impression of pedicle valve, anterior and normal views (x2) of chert-impression of brachial valve, and interior of silicified pedicle valve. Paratypes from locality TF-174, approximately 15 feet below top of Threadgill member of Tanyard formation.

(13-14) Holotype pedicle valve (x2, x1) from locality TF-175, top of Threadgill member of Tanyard formation.

(15-18) Interior of brachial valve (x1), posterior and normal, views of exterior of brachial valve (x2), and exterior of pedicle valve (x2). Three paratypes from locality TF-196, measured as 285.5 feet above base of Tanyard formation, near top of Threadgill member.

19-32, 36. *Finkelnburgia helleri* Cloud, n. sp..........................

(19-21, 36) Normal views of exterior of brachial (x1), exterior of pedicle (x1), interior of pedicle (x2), and interior of brachial (x2) valves. Four paratypes from locality TF-409, about 20 feet above base of Tanyard formation.

(22-25) Posterior (x2), anterior (x2), and two normal (x2, x1) views of exterior of holotype brachial valve; **(26)** exterior of brachial valve (x1); **(27-28)** exterior of pedicle valve (x1, x2); **(29-30)** exterior and interior of pedicle valve (x2); and **(31-32)** exterior and interior of brachial valve (x2). Holotype and paratypes from locality TF-229. About 30 to 50 feet above base of Tanyard formation.

33-35, 37-46. *Polytoechia bella* Cloud, n. sp..........................

(33-34, 45) Posterior, anterior, and interior views (x2) of pedicle valve; **(35, 39-40, 46)** lateral (x2), anterior (x2), and two normal brachial (x2, x3) views of the immature holotype; and **(37-38)** oblique interior and normal exterior views (x2) of brachial valve. Holotype and paratypes from locality TF-346, about 205 to 210 feet below top of El Paso formation, Hueco Mountains.

(41-44) Oblique interior (x1, x2), normal exterior (x2), and posterior (x2) views of a paratype pedicle valve obtained from locality TF-347, about 4 feet stratigraphically above specimens just noted.

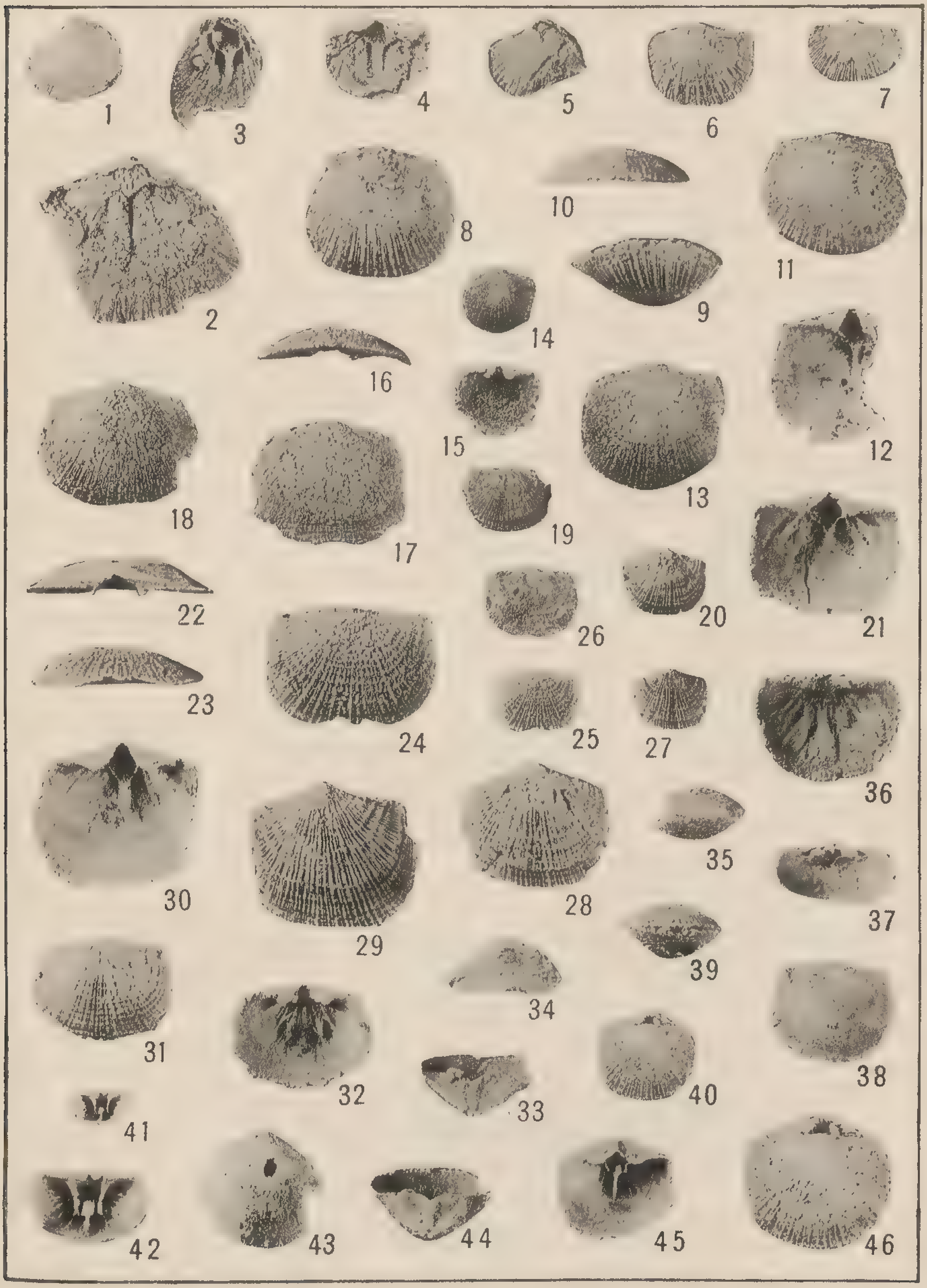
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PLATE 2[1]

POLYTOECHIA, TETRALOBULA, SYNTROPHINA, CALLIGLYPHA

Figure — Page

1-9. *Polytoechia bella* Cloud, n. sp. . . . .
(**1, 3**) Normal interior views (x1, x2) of two pedicle valves; (**2, 4-5, 8**) Posterior (x2), normal exterior (x2), and two normal interior (x2, x1) views of pedicle valve; and (**6-7, 9**) posterior, normal exterior, and normal interior views of brachial valve. Paratypes from locality TF-450, about 1010 feet above base and 580 feet below top of El Paso formation at El Paso.

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[1] **Plate inadvertently reduced in duplication and all magnifications 0.9x those given.**

Figure Page

10-13, 17. *Syntrophina campbelli* (Walcott)........................

(10-11) Chert-impressions of interiors of pedicle (x2) and brachial (x1) valves from locality B-50. Within 50 feet of base of Gorman formation.

(12) Incomplete chert-impression of interior of brachial valve (x2) from locality TF-171. Estimated as 70 to 90 feet above base of Gorman formation.

(13, 17) Chert-impressions of interiors of brachial and pedicle valves (x2) from locality TF-170. Estimated as 90 to 110 feet above base of Gorman formation.

14, 18-19. *Syntrophina magna* Ulrich and Cooper...................

Normal exterior and interior views (x1) of nearly complete brachial valve, and oblique anterior view (x2) of interior of incomplete brachial valve. Locality TF-316, about 91 feet above base of El Paso formation in Beach Mountain section.

15-16, 21-22. *Tetralobula texana* Ulrich and Cooper..................

Interior of beak region of pedicle valve (x3), exterior of brachial valve (x2), and normal exterior and interior views (x2) of small brachial valve. U. S. N. M. 92874, syntypes from lower beds of Tanyard formation. Photographs by courtesy Dr. G. A. Cooper.

20, 23-31. *Syntrophina percarinata* Cloud, n. sp.....................

(20, 23, 24, 26) Lateral (x1), two brachial (x1, x2), and posterior (x2) views of immature whole specimen; **(25, 30-31)** normal exterior (x1), anterior (x2), and oblique interior (x2) views of holotype brachial valve; and **(27-29)** lateral and normal interior and exterior views (x2) of pedicle valve. Holotype and paratypes from locality TF-354, approximately 405 feet above base of El Paso formation, El Paso.

32-45. *Calliglypha miseri* Cloud, n. gen., n. sp.......................

(32-34) Normal interior and exterior (x2) and posterior (x3) views of pedicle valve; **(35-37)** anterior (x2) and two normal exterior views (x2, x1) of pedicle valve; **(38-40)** anterior (x3), oblique interior (x3), and normal exterior (x2) views of a third pedicle valve; and **(41-45)** three normal exterior views (x1, x2, x3) and normal and oblique interior views (x3) of holotype brachial valve. Holotype and paratypes from locality TF-347, Hueco Mountains.

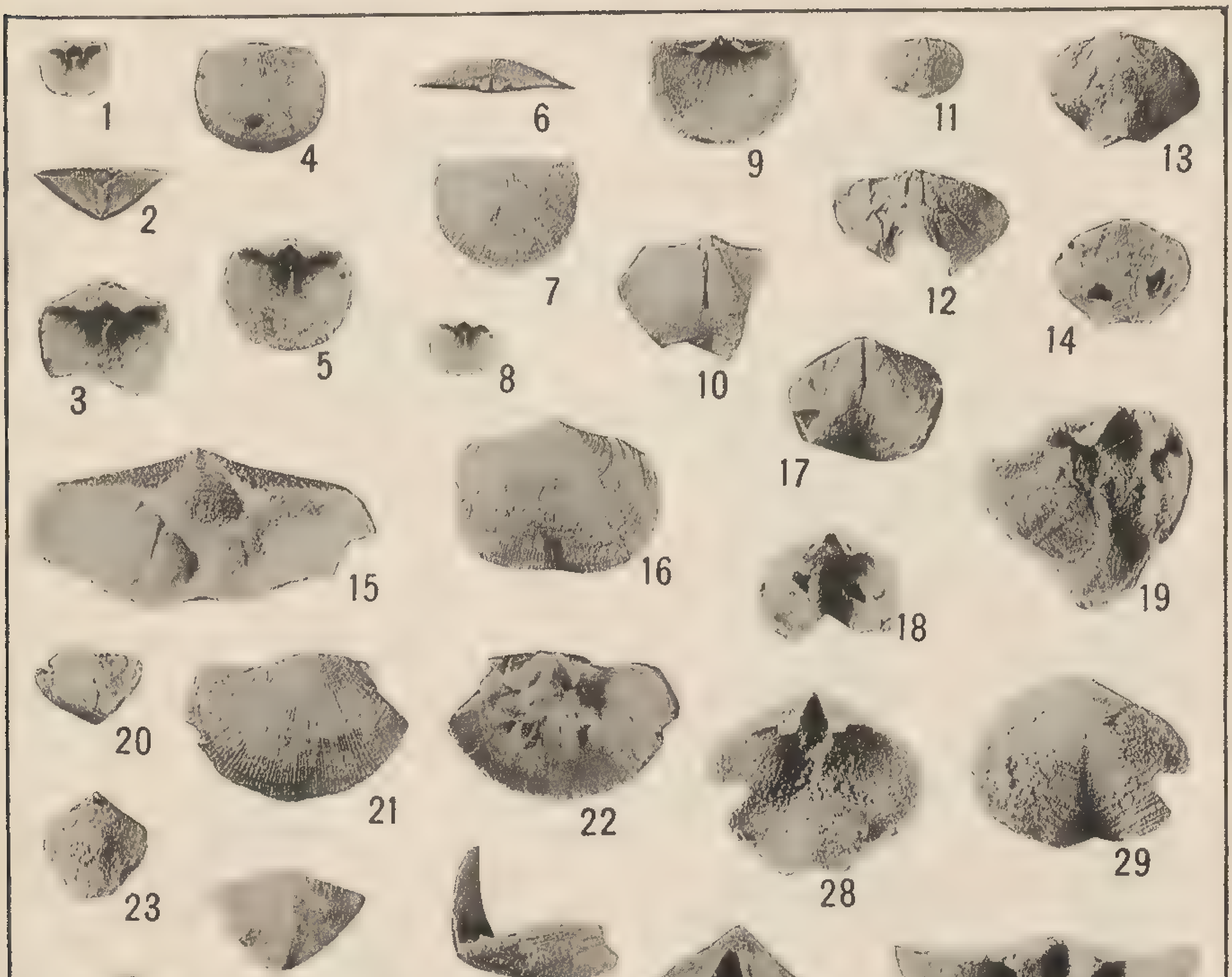
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PLATE 3[1]

DIAPHELASMA

1-2, 10-27. *Diaphelasma oklahomense* Ulrich and Cooper..............

(**1**, **11**) Normal interior and exterior views (x2) of brachial valve; (**2**) normal interior view (x2) of pedicle valve; (**12**, **15**) posterior and normal exterior views (x2, x1) of brachial valve; (**13-14**, **17**) normal exterior (x1, x2) and interior (x2) views of pedicle valve. Locality TF-316, about 91 feet above base of El Paso formation in Beach Mountain section.

(**10**, **20**, **25-26**) Lateral (x2), posterior (x2), anterior (x2), and brachial (x1) views of a complete specimen; and (**27**) brachial view (x2) of another whole specimen. Locality 16T-2-42C, 86 feet below top of Gorman formation.

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[1] **Plate inadvertently reduced in duplication and all magnifications 0.9x those given.**

Figure | Page

(**16**) oblique interior view (x2) of beak-end of pedicle valve; (**18-19, 22-23**) posterior (x1), lateral (x2), and two brachial (x2, x1) views of a nearly complete specimen; (**21**) oblique interior view (x2) of incomplete brachial valve; and (**24**) anterior view (x1) of a complete specimen (pedicle side up). Locality 16T-2-41A, approximately same stratigraphic position as 16T-2-42C.

3-9. *Diaphelasma* cf. *D. oklahomense* Ulrich and Cooper . . . .
(**3-4**) Lateral and normal exterior views (x1) of brachial valve; (**5**) oblique interior view (x2) of pedicle valve; (**6, 8**) normal interior and anterior views of pedicle valve; and (**7, 9**) normal exterior and posterior views of another pedicle valve. Specimens collected by Drs. Josiah Bridge and G. A. Cooper from a point approximately 100 feet above base of El Paso formation in Beach Mountain section.

28-48. *Diaphelasma pennsylvanicum* Ulrich and Cooper . . . .
(**28-30**) Brachial, posterior, and lateral views (x1) of small whole specimen from locality TF-251, about 60 feet below top of Gorman formation.

(**31**) Normal interior view (x1) of pedicle valve; (**32**) oblique interior view (x2) of beak end of brachial valve; (**33-34**) normal exterior (x2) and interior (x1) views of incomplete brachial valve; (**35**) normal interior view (x1) of brachial valve; and (**36**) interior view (x2) of beak-end of pedicle valve. Locality 16T-2-42E, 46 feet below top of Gorman formation.

(**37, 41**) Normal interior (x1) and lateral (x2) views of incomplete pedicle valve; (**38-40**) normal interior (x1) and exterior (x2), and posterior (x2) views of brachial valve; (**42**) oblique internal view (x1) of beak-end of pedicle valve; (**43-45**) normal interior (x1), anterior (x2), and normal exterior (x2) views of pedicle valve; and (**46-48**) posterior (x1), lateral (x2), and normal external (x2) views of brachial valve. Locality TF-353. Approximately 350 to 355 feet above base of El Paso formation, at El Paso.

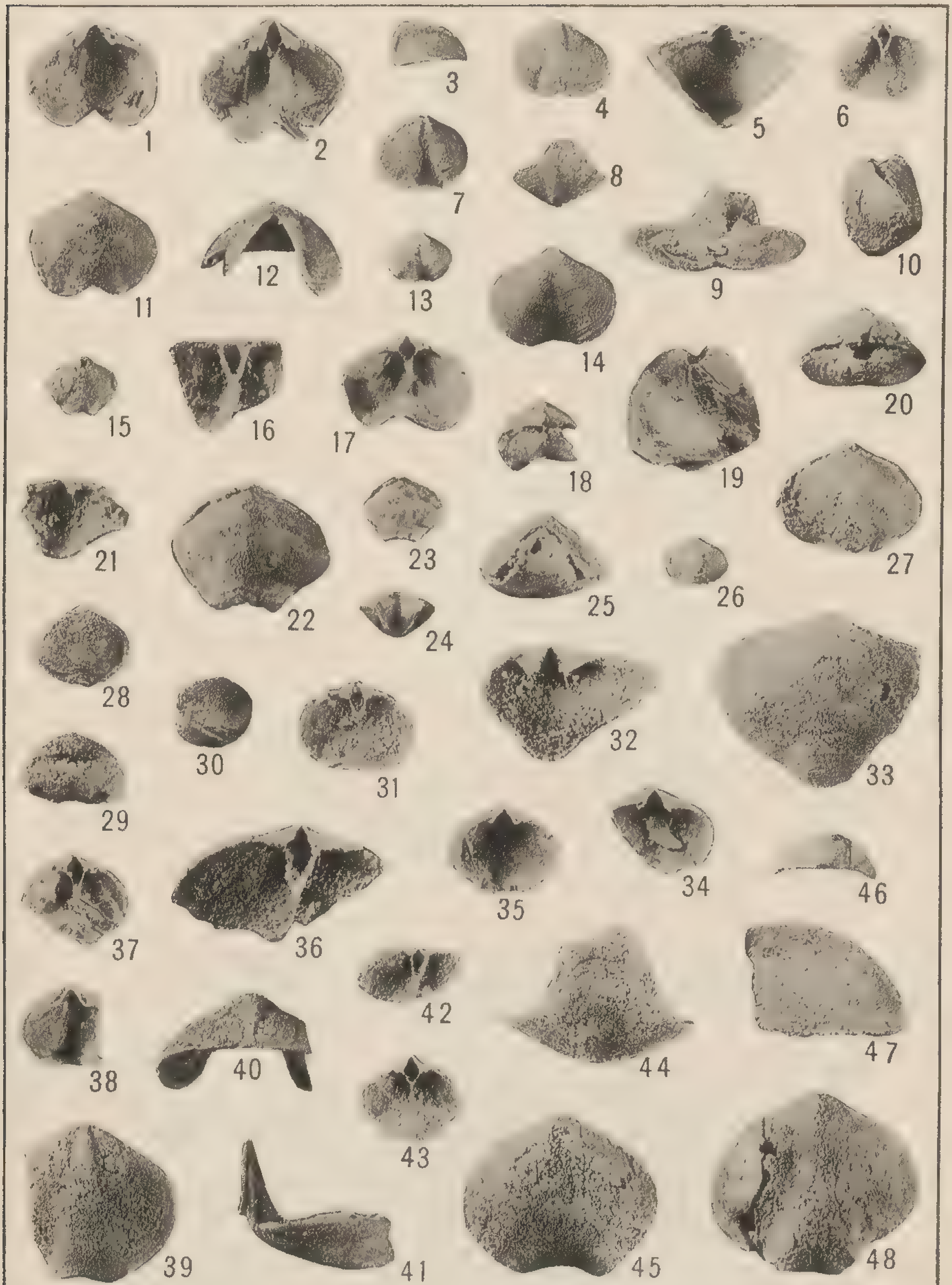
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PLATE 4[1]

SYNTROPHINA, SYNTROPHOPSIS, XENELASMA, STICHOTROPHIA

Figure Page

1-7. *Syntrophinella deckeri* Cloud, n. sp. . . . .
(**1-2**) Normal exterior and interior views (x2) of pedicle valve, (**3-4**) normal exterior and interior views (x2) of holotype brachial valve, (**5**) exterior (x2) of another pedicle valve, (**6**) interior (x2) of another brachial valve, and (**7**) oblique internal view (x2) of beak-end of pedicle valve. Holotype and paratypes from locality OF-4, near middle of Cool Creek formation, Arbuckle Mountains, Oklahoma.

[1] **Plate inadvertently reduced in duplication and all magnifications 0.9x those given.**

Figure Page

8-15. *Syntrophinella warreni* Cloud, n. sp. . . . .

(8, 10-12) Posterior (x2), two normal exterior (x1, x2), and anterior (x2) views of holotype brachial valve; **(9)** interior of beak-end of a pedicle valve (x1); **(13-14)** anterior and normal exterior views (x2) of pedicle valve. Holotype and paratypes, preserved in chert, from locality 205T-1-20A, a few feet above zone of *Archaeoscyphia* at middle of Gorman formation.

(15) Normal exterior view of paratype brachial valve (x2) in chert from locality TF-250, about 220 feet below top of Gorman formation.

16-26. *Syntrophopsis praecursor* Cloud, n. sp. . . . .

(16-17) Normal interior and exterior views of incomplete pedicle valve (x1); **(18)** interior of incomplete brachial valve (x1); **(19)** oblique internal view (x2) of beak-end of pedicle valve; **(20)** oblique interior view (x2) of beak-end of pedicle valve. Locality CF-1, about 20 feet above lowest exposures and near base of Manitou formation, just west of Wellsville, Colorado.

(21) Normal exterior view of brachial valve (x2); **(22)** oblique interior view (x2) of incomplete brachial valve; **(23-26)** oblique interior, normal interior, and normal exterior views (x2), and a second normal internal view (x1) of holotype pedicle valve. Holotype and paratypes from locality TF-360, estimated to be about 440 feet above base of El Paso formation.

27-37. *Xenelasma syntrophioides* Ulrich and Cooper. . . . .

(27-28) Normal and oblique internal views (x2) of pedicle valve from locality TF-127. Top surface of top bed of Gorman formation (= base of Honeycut formation), San Saba County.

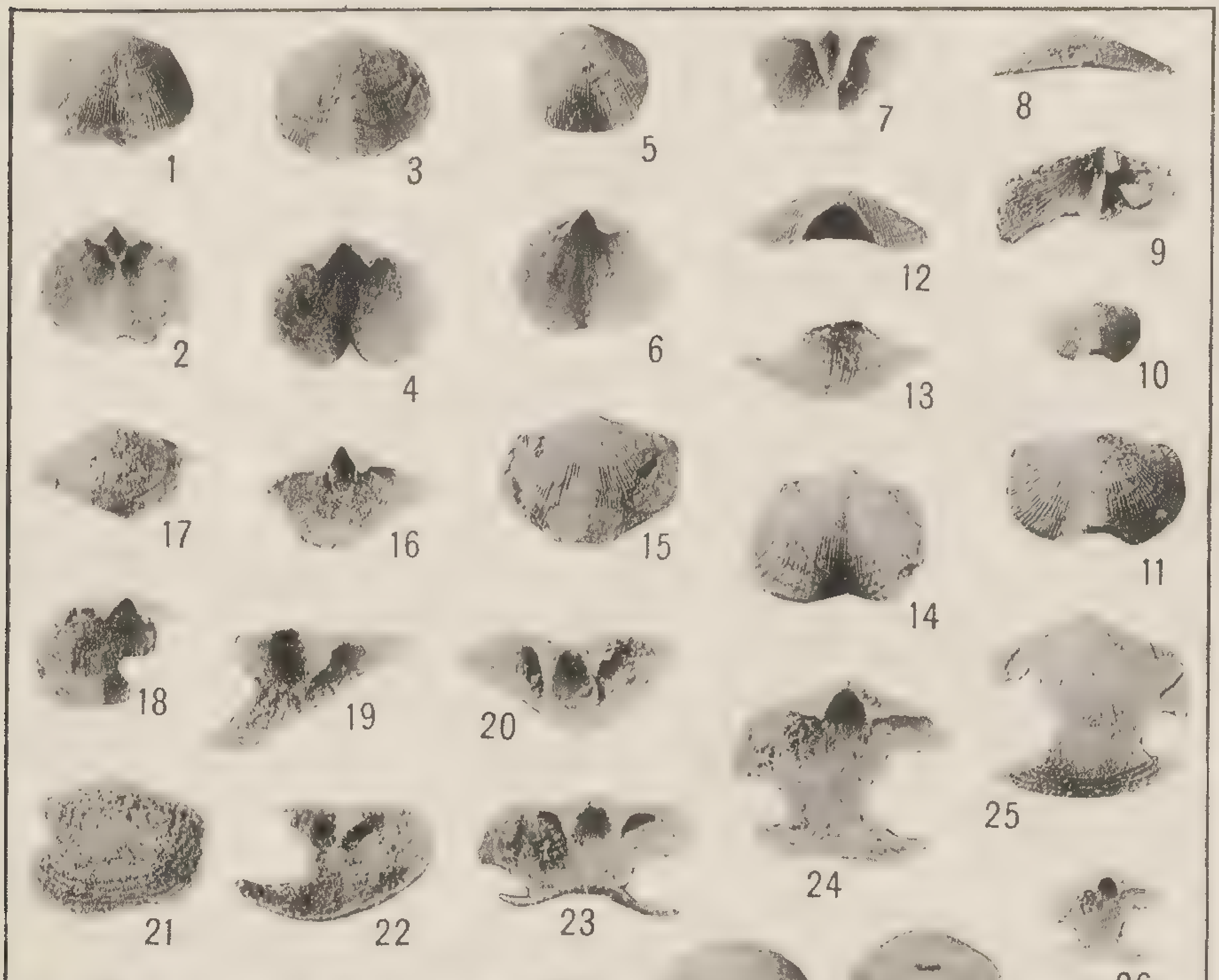
(29-30) Brachial and anterior views (x2) of a nearly complete, unusually robust specimen from locality TF-378. About 10 feet above base of Honeycut formation, Llano County.

(31-34) Anterior (x2), two brachial (x1, x2), and pedicle (x2) views of a complete specimen; and **(35)** oblique internal view (x2) of a brachial valve. Locality TF-140, top surface of top bed of Gorman formation (=base of Honeycut formation), San Saba County.

(36-37) Oblique posterior view (x2) of internal impression of brachial valve and normal view (x2) of internal impression of pedicle valve. TF-238, lower beds of Honeycut formation, Llano County.

38-44. *Stichotrophia lamellata* Cooper, n. gen., n. sp. . . . .

(38, 44) Normal interior and exterior views (x2) of incomplete pedicle valve; **(39, 43)** normal exterior views (x1, x2) of holotype brachial valve; **(40, 42)** normal and oblique internal views (x2, x4) of an incomplete brachial valve; and **(41)** interior of a second pedicle valve (x2). Holotype and paratypes from Longview limestone, Middletown Quadrangle, Virginia.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